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WATER POLLUTION INVESTIGATION: GENESEE RIVER AND ROCHESTER AREA

P. E. Moffa, et al

O'Brien and Gere Engineers, Incorporated

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WATER POLLUTION INVESTIGATION: GENESEE RIVER AND ROCHESTER AREA

O'BRIEN & GERE ENGINEERS, Inc.

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION V ENFORCEMENT DIVISION
GREAT LAKES INITIATIVE CONTRACT PROGRAM

JANUARY 1975

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A study of the lower Genesse River in Monroe County, New York was conducted to investigate the impact of pollution sources, both point and non-point, on the water quality of the Genesee River. It was determined that four major point-source discharges have a significant effect on the dissolved oxygen levels present in the River: 1) Oatka Creek, 2) Gates-Chili-Ogden Sewage Treatment Plant, 3) N.Y.S. Barge Canal, and 4) Kodak Wastewater Treatment Plant. Three other factors of a non-point source nature affect the dissolved oxygen levels in the River: 1) non-point source contributions from agricultural, forested, and pasture lands in the upstream regions, 2) benthic demand in the lower region in the vicinity of the mouth, and 3) horizontal dispersion effects in the lower region.

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The implementation of BPCTCA to municipal and industrial discharges would result in little improvement of the projected dissolved oxygen concentration under average flow conditions. Under MA7CD/10 YR flow conditions BPCTCA would result in the River DO meeting the stream standard in all reaches except those downstream of the Kodak Wastewater Treatment Plant discharge.

Projections of 85, 90, 95, and 98 percent removal of carbonaceous and nitrogenous oxygen demanding constituents from the municipal treatment plant will not significantly increase the DO of the River above that obtained by the application of "municipal" secondary treatment.

There was no measurable single constitutent contributing toxic conditions to inhibit the aquatic structure within the study area of the Genesee River. During the field investigations conducted as part of this study, a number of samplings in the reaches below the Rochester falls did reflect concentrations of metals, ammonia, and phenols at undesirable levels.

This report was submitted in fulfillment of Project Number 68-01-1574 by O'Brien & Gere Engineers, Inc., under the sponsorship of the U.S. Environmental Protection Agency.

WATER POLLUTION INVESTIGATION:
GENESEE RIVER AND ROCHESTER AREA

by

Peter E. Moffa
Cornelius B. Murphy
Dwight A. MacArthur

O'BRIEN & GERE ENGINEERS, INC.

In fulfillment of

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U.S. ENVIRONMENTAL PROTECTION AGENCY
Region V

Great Lakes Initiative Contract Program
Report Number: EPA-905/9-74-016

EPA Project Officer: Howard Zar

January 1975

This report has been developed under auspices of the Great Lakes Initiative Contract Program. The purpose of the Program is to obtain additional data regarding the present nature and trends in water quality, aquatic life, and waste loadings in areas of the Great Lakes with the worst water pollution problems. The data thus obtained is being used to assist in the development of waste discharge permits under provision of the Federal Water Pollution Control Act Amendments of 1972 and in meeting commitments under the Great Lakes Water Quality Agreement between the U.S. and Canada for accelerated effort to abate and control water pollution in the Great Lakes.

This report has been reviewed by the U.S. Environmental Protection Agency and approved for publication. Approval does not signify that the contents necessarily reflect the views of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

ABSTRACT

A study of the lower Genesee River in Monroe County, New York was conducted to investigate the impact of pollution sources, both point and non-point, on the water quality of the Genesee River. It was determined that four major point-source discharges have a significant effect on the dissolved oxygen levels present in the River: 1) Oatka Creek, 2) Gates-Chili-Ogden Sewage Treatment Plant, 3) N.Y.S. Barge Canal, and 4) Kodak Wastewater Treatment Plant. Three other factors of a non-point source nature affect the dissolved oxygen levels in the River: 1) non-point source contributions from agricultural, forested, and pasture lands in the upstream regions, 2) benthic demand in the lower region in the vicinity of the mouth, and 3) horizontal dispersion effects in the lower region.

Under average flow conditions the level of dissolved oxygen is of sufficient magnitude to meet the stream standard of 5.0 mg/l required for non-trout waters. However, under minimum average seven consecutive day flow conditions (MA7CD/10 YR) the stream standard would be contravened in the reaches downstream of the Barge Canal.

The implementation of BPCTCA to municipal and industrial discharges would result in little improvement of the projected dissolved oxygen concentration under average flow conditions. Under MA7CD/10 YR flow conditions BPCTCA would result in the River DO meeting the stream standard in all reaches except those downstream of the Kodak Wastewater Treatment Plant discharge.

Projections of 85, 90, 95, and 98 percent removal of carbonaceous and nitrogenous oxygen demanding constituents from the municipal treatment plant will not significantly increase the DO of the River above that obtained by the application of "municipal" secondary treatment.

There was no measurable single constituent contributing toxic conditions to inhibit the aquatic structure within the study area of the Genesee River. During the field investigations conducted as part of this study, a number of samplings in the reaches below the Rochester falls did reflect concentrations of metals, ammonia, and phenols at undesirable levels.

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SECTION I

CONCLUSIONS

From the analysis of results obtained throughout the application of the Stream Assimilation Capacity Model and data collected during the sampling program, the following conclusions are made:

1. Four major point-source discharges have a significant effect on the dissolved oxygen levels present in the Genesee River. These four discharges in the order of their location proceeding downstream are:

   a. Oatka Creek which tends to raise the River DO upon dilution.

   b. Gates-Chili-Ogden Sewage Treatment Plant discharge which contributes a significant carbonaceous and nitrogenous ultimate oxygen demand load on the River just upstream of the point of entry of the Barge Canal waters.

   c. Barge Canal which causes a significant decrease in the DO as a result of the high flow and depressed dissolved oxygen concentration of the Canal. The influence is particularly significant under critical low flow (MA7CD/10) conditions.

   d. Kodak Sewage Treatment Plant discharge which contributes a significant carbonaceous and nitrogeneous ultimate oxygen demand loading on the Genesee River just prior to its discharge to Lake Ontario.

2. Three other factors of a non-point source nature affect the dissolved oxygen levels in the Genesee River:

   a. Non-point source contributions from agricultural, forested, and pasture lands in the upstream regions.

   b. Benthic demand exerted by settlement of oxygen demanding materials in the quiescent downstream region of the River in the vicinity of its mouth.

   c. Horizontal dispersion effects occurring in the lower reaches of the Genesee River, due to the influence of Lake Ontario.

3. A number of other largely insignificant industrial and municipal point-sources exert only a minor effect on the level of dissolved oxygen measured in the Genesee River within the study area.

   a. Avon Sewage Treatment Plant discharge

   b. Honeoye Creek

   c. Scottsville Service Area Treatment Plant discharge (operated by the New York State Thruway Authority).

   d. Black Creek

e. Dry weather overflows in the City of Rochester Combined Sewer System. The negligible effects of the overflows most likely do not hold true during periods of rainfall and spring runoff.

f. Bausch and Lomb Inc. discharge. Although no effluent data had been collected at the time of this writing, downstream conditions measured under this study indicate a minimal effect on the River DO from this discharge. Actual sampling and analysis would be necessary to verify this assumption.

4. Under average flow conditions, the level of dissolved oxygen measured in the Genesee River is of sufficient magnitude to meet the stream standard of 5.0 mg/l required for non-trout waters. From the Village of Avon to a location just upstream of the Kodak discharge, the DO level is maintained above 7.0 mg/l. From Kodak discharge to the mouth of the River, the DO declines to a value slightly above 5.0 mg/l. The decrease in DO in this lower reach is largely the result of the combined effects of the Kodak discharge, benethic demand and dispersion factors.

5. Under Minimum Average Seven Consecutive Day flow conditions expected to recur once in a ten-year period (MA7CD/10), the dissolved oxygen level is projected to remain above a value of 6.0 mg/l until confluence with the Barge Canal waters. At that point, mixing of the Canal and River waters results in a projected drop in DO to 4.98 mg/l- - just below the minimum allowable DO value of 5.00 mg/l. Following the latter, the dissolved oxygen concentration within the river continues to slowly decline as a result of the minor effects of Bausch & Lomb and the dry weather overflow discharges. At the point of the discharge from Eastman Kodak the DO is projected to be 4.66 mg/l and then to decline ultimately to a minimum of 2.66 mg/l at the Stutson Street Bridge. From the Barge Canal to the mouth, the stream standard of 5.0 mg/l is contravened under projected MA7CD/10 flow conditions.

6. The implementation of BPCTCA to municipal and industrial discharges would result in little improvement of the projected River dissolved oxygen concentration under average flow conditions. The maximum projected increase in dissolved oxygen concentration of 0.24 mg/l in the River would occur at the Stutson Street Bridge. Under MA7CD/10 flow conditions, the implementation of BPCTCA would raise the level of dissolved oxygen concentration above the minimum allowable for all sections from the Village of Avon to the Kodak discharge. However, from Kodak to the mouth, the projected DO would still not meet the stream standard of 5.0 mg/l.

7. Projections of 85, 90, 95, and 98 percent removal of carbonaceous and nitrogenous oxygen demanding constituents from the municipal treatment will not significantly increase the DO of the River above that obtained by the application of "municipal" secondary treatment.

8. Application of 98 percent removal of carbonaceous and nitrogenous oxygen demanding constituents for both municipal and industrial discharges would result in a significant increase in DO in the region downstream of the Kodak discharge. The projected DO anticipated at Stutson Street Bridge would increase from 2.66 mg/l under MA7CD/10 flow conditions to 4.17 mg/l as a result of 98% removal of both carbonaeous and nitrogenous ultimate oxygen demand. However, the River DO would still be below the minimum allowable DO of 5.0 mg/l in the lower reach.

9. The Barge Canal significantly affects the DO levels predicted in the River downstream of the Canal. This is due to the high flow volumes and associated depressed DO concentrations characteristic of the Canal discharge in comparison to the River flow. The flow of the Barge Canal to the Genesee River accounts for approximately 48% of the total River flow under average flow conditions. Under MA7CD/10 conditions, the Barge Canal represents approximately 70% of the total Genesee River flow.

10. The Benthic Oxygen Demand results in a significant reduction in the DO concentration predicted in the River downstream of the Eastman Kodak discharge and accounts for a reduction of approximately 0.62 mg/l of DO in that region.

11. The effect of dispersion related to the influence of Lake Ontario on that region of the main stem downstream of the Eastman Kodak discharge, is significant. The magnitude of the influence is of course dependent on the velocity of the river, relative lake and river elevations and respective differences in DO.

12. There was no measureable single constituent contributing toxic conditions to inhibit the aquatic structure within the study area of the Genesee River. This does not preclude the presence of synergystic effects from multiple interactions within the aquatic environment existant in isolated sections of the Genesee River. During the field investigations conducted in the course of this study, a number of samplings below the Eastman Kodak outfall did reflect concentrations of metals, ammonia, and phenols at undesirable levels.

13. The most important factors affecting the water quality of the Rochester embayment area and subsequently Lake Ontario in general, involves the high seasonal levels of suspended material carried by the Genesee River, the level of nutrients contributing to the Cladophora blooms in Lake Ontario and the dredging activity and subsequent dumping of the anoxic sludge in the near shore area of Lake Ontario.

SECTION II

RECOMMENDATIONS

Since the concentration of dissolved oxygen predicted in the Genesee River upstream of the Barge Canal meets or exceeds the minimum allowable DO concentration of 5.0 mg/l at all times, this section does not warrant extensive evaluation from the point of view of oxygen demand considerations. The major area of concern with regard to achieving minimum oxygen demand conditions must center on the region from the Barge Canal to the mouth of the River. Recommendations concerning the improvement of DO levels in the Genesee River are as follows:

1. Improve the quality of water presently existing within the Barge Canal. This could be done by limiting or controlling the number and quality of all discharges to Canal waters which would ultimately find their way to the Genesee River. By insuring that the concentration of DO within the Barge Canal is maintained above 6.0 mg/l at all times of the year, the present and projected DO depression which occurs after the intrusion of the Barge Canal would be reduced. This would put an inequitable burden on discharges to the canal.

2. Provide at least 85% removal of carbonaceous oxygen demand and 30% removal of nitrogeneous demand as the minimum treatment for the Gates-Chili-Ogden Sewage Treatment Plant. An effort should also be made to increase the DO concentration of the effluent to 6.0-7.0 mg/l.

3. Provide treatment of the Eastman Kodak waste to reduce the level of both carbonaceous and nitrogenous oxygen demand by 85%. An effort should also be made to increase the DO of the treated process waste to 6.0-7.0 mg/l.

4. The benthic demand should also be reduced in the lower reaches of the Genesee River. This may be accomplished by reducing through conservation practices the silt being eroded from farm land, forest land, and river banks, reducing the solids being discharged from the Rochester combined sewer system under both dry and wet weather conditions, and by improving the removal of suspended solids from municipal and industrial treatment plants.

5. A program should be undertaken to reduce the overall impact of both the wet and dry weather flows from the Rochester Combined Sewer System.

6. A sampling and analysis program should be conducted after the implementation of the 1977 BPCTCA effluent limitations. This should be a pre-requisite in assisting the development of 1983 Best Available Technology Economically Achievable (BATEA) effluent limitations.

7. In developing any future sampling and analysis program, due consideration should be given to employing the capability being developed under the Earth Resources Technology Satellite (ERTS) program.

8. The modeling effort shows that any increase in the removal of ultimate oxygen demanding constituents over and above that defined by BPCTCA will not have a major effect on the level of dissolved oxygen predicted within the Genesee River. The application of anticipated BATEA could therefore not be justified from the point of view of maintenance of a critical level of dissolved oxygen within the receiving stream. The same conclusion is drawn regarding municipal treatment beyond the secondary stage.

9. Considerable efforts should be expended to reduce the level of heavy metals, toxicants, and nutrients being discharged by industry to the Genesee River. Particular attentions should be given to the reduction in levels of Zn, Cu, Cn$^-$, and NH_3(N).

10. An effort should also be conducted to reduce the heavy metal load being discharged to the GCO interceptor system.

SECTION III

INTRODUCTION

BACKGROUND

As part of an overall program sponsored by the United States Environmental Protection Agency for the investigation of "Eleven Special Attention Areas" in the Great Lakes Region, a study of the lower Genesee River Basin was conducted under EPA Grant No. 68-01-1574 during the summer and fall of 1973.

This study investigated the impact of pollution sources, both point and non-point sources, on water quality under three conditions:

1. Existing Conditions.
2. Secondary treatment and nutrient removal for all municipal treatment plants and best practical control technology BPCTCA for all industrial discharges.
3. Additional treatment requirements deemed necessary to meet New York State Class A and Class B stream water quality levels.

To determine the above conditions, further studies were necessary and included:

1. Historical stream data review.
2. Historical effluent data review.
3. Stream surveys to determine the waste assimilation capacity of the lower Genesee River.
4. A definition of the biochemical oxygen demand (BOD) and nitrogenous oxygen demand (NOD) mechanisms in the river.

A biological survey was conducted simultaneously with the water quality survey to determine biological reactions to the waste loadings. Biological samples as well as fish counts were collected to determine the quality of aquatic life inhabiting the stream as a result of the waste discharge effects. In short, analytical, biological and hydrological data describing the character, volume and effects on the receiving waters were collected on the lower Genesee River. A list of the chemical parameters measured is found in Appendix B of this report.

BASIN DESCRIPTION

The Genesee River Basin consists of the main watercourse and its 31 tributaries. There are a number of areas both off and on the main steam which have serious water quality impairment problems. Seven stretches of the main stem and its tributaries have been identified as zones suffering from significant water pollution.(1)

The significant sources of the above-mentioned water quality deterioration are in the form of:

1. Municipal Point Source Water Discharges - 27 municipalities currently discharging 13.5 MGD

2. Industrial Point Source Discharges - 26 industries currently discharging 43.3 MGD
3. Urban Combined Sewer Overflows
4. Agricultural Non-Point Source Contributions
5. Tile Field Sanitary Leachate
6. Dredging Operations - affects the embayment area and lower reaches of the main stem.

In addition, the Lake Ontario Embayment Area receives, at the present time, 80 MGD of primary treated waste supplying a tremendous additional loading of biochemical oxygen demand, dissolved solids, and nutrients. Circulation in the embayment area is at times non-existent creating severely polluted localized conditions. To compound the embayment problems, the Army Corps of Engineers dredge the Rochester harbor on a fairly regular basis. The dredging operations involve the lower 5 miles of the channel and the included turning basins. The dredged material has in the past been deposited in a designated area in the embayment some 2 miles northeast from the mouth of the Genesee River.

The effect of the dredging is to exert an extreme oxygen-demand at both the dredging and dumping sites. The colloidal and dissolved organic matter and nutrients are discharged and circulated in the process of conducting the dredging operations and upon dumping the dredgings.

The main water courses and bodies of water in the study area include the Genesee River, Black Creek, Oatka Creek and Honeoye Creek. The drainage areas, length, and average slope of the major streams are shown in Table 1.

Table 1 - Drainage Area, Length and Average Slope of Major Streams in the Genesee River Basin

Stream	Drainage Area sq. mi.	Length of Stream mi.	Average Slope ft/mi.
Genesee River-Mt. Morris to Rochester	1400	70	0.8
Genesee River-Lower Falls to Lake Ontario	– –	6	– –
Black Creek	192	56	13
Oatka Creek	215	60	20
Honeoye Creek	266	34	8

The Barge Canal crosses the Genesee nearly at right angles south of Rochester. On either side of the River crossing, guardlocks permit regulation of canal waters diverted from Lake Erie. Part of the Canal water is diverted into the Genesee River and part into the eastern sector of the Canal. Rochester Gas and Electric is entitled to divert 375 cfs of canal water into the Genesee River and normally this amount of flow is diverted from the Canal to the River.

On a cfs per square miles basis, the annual average flow in the Genesee River is about 1.10 cfs per square mile at Rochester and 1.25 cfs per square mile in the headwaters. The value for Rochester is high because of the large volume of water diverted to the Genesee from the Canal from outside the Basin. Other annual average flows per square mile include 1.12 cfs for Genesee River at Avon, 0.83 cfs for Black Creek at Churchville, 0.85 cfs for Honeoye Creek at Honeoye Falls, and 0.95 for Oatka Creek at Garbutt.

The mean minimum and 7 day low stream flows occurring once every ten years for the major streams as observed at long-term gauging stations are shown in table 2.

Table 2 - Stream Flow Records

Location	Years of Record	Min. Flows cfs	MA7CD	Annual Mean Flow
Genesee River-Mt. Morris	53	12	70	1600
Genesee River-Avon	9	– –	75	1826
Genesee River-Rochester	43	10	370	2738
Honeoye Creek-Honeoye Falls	18	0.1	0.3	167
Oatka Creek-Garbutt	18	3.3	19	198
Black Creek-Churchville	18	0.3	0.9	102

The scope of this study includes that portion of the Genesee River extending from Avon, New York to the mouth of the River at Lake Ontario. The main emphasis is on the main stem of the river with some examination of the effects of tributaries on the water quality of the Genesee River. A map of the study area is included in the form of Figure 1.

The depth of the Genesee River in the study area varies from 2 meters at Avon to a depth of 11 meters at Stutson Street Bridge near the mouth. Until the river reaches the first series of waterfalls in the City of Rochester, the depth is fairly uniform and averages above 4 meters from station 2 to station 7. Between sampling stations 7 and 8, three significant river elevation changes occur, the first of which involves a drop of approximately 22 feet just downstream from Central Avenue bridge, the second is a drop of 90 feet near the Penn Central R.R. crossing, and the third change is a drop of 143 feet near Driving Park Avenue Bridge over the Genesee River. These falls result in a net drop of approximately 267 feet between stations 7 and 8.

At station 8 the depth of the River increases to 7 meters, at station 9 to 8 meters and at Station 11 to 11 meters. In this lower stretch from Station 8 to Station 11, the slope of the river at the water surface is very minimal at low flows and may be as little as one foot in 5 miles. This may result in a strong estuarine effect by Lake Ontario during periods of low flow. The slope of the River in the upper reaches of the study area averages only about one foot per mile and this also is conducive to making the River a sluggish, meandering body of water.

SECTION IV

HISTORICAL DATA AND SAMPLING PROGRAM

There are four major sources of information regarding the water quality in the main stem, tributaries and the embayment area associated with the Genesee River Basin as described below:

1. The New York State Department of Environmental Conservation operates a State-wide Water Quality Surveillance Network in accordance with Section 1210 of the Public Health Law. In the Genesee River Basin, there are nine such sampling stations, five of these being on the main stem and one each on Honeoye Creek, Oatka Creek, Black Creek and at the mouth of the River. Since 1965, samples have been taken on a frequency of at least one per month. Thirty-seven physical and bacteriological parameters were obtained at the time of each sampling. This is one of the most complete compilations of water quality data on the whole basin particularly in the areas of the headwaters (outside of Monroe County).(2,3)

2. The U.S. Environmental Protection Agency has also compiled data from 1965 to present at a sampling station in the harbor area of the Genesee River (Stutson St. Bridge). The sampling and analysis is currently being conducted as part of the IFYGL program on a bi-weekly basis. In addition, EPA has obtained water quality information relative to the assessment of the effect of the Genesee Harbor dredging operations. Fifteen stations have been selected as sources of this information in both the harbor and embayment areas.

3. The United States Geological Survey maintains six flow gauging stations on the Genesee supplying the only extensive flow data. The flow information within the Rochester city limits is obtained from the turbine operations maintained by Rochester Gas and Electric.

4. The major source of industrial point source information was through the National Pollutant Discharge Elimination System (NPDES) permit system. This information has been compiled over the last two years and contains minimum, maximum, and average loading data for wastewater components anticipated under the specific industrial classification. Although many of the discharge permits were partially incomplete and based on isolated grab samples, the data was found to be sufficient for the evaluations reported herein.

The Monroe County Pure Waters Agency along with other communities and sewage districts in the basin was a source of information regarding sanitary wastewater and urban combined sewer overflows. Data from a preliminary study by Monroe County Pure Waters,[86] on the characterization and treatability of the combined sewer overflows was also incorporated in the modeling projections discussed in Section VIII.

Other sources contacted for water quality data and flow data in the basin include:

U.S. Army Corps of Engineers for flow data at Mt. Morris Dam.

Rochester Gas and Electric Corp. for flow data at Driving Park Hydro Station.

Eastman Kodak for Kodak Park Treatment Plant and effluent data and cross-sections of the Genesee River at the treatment plant.

Monroe County Department of Health for flows and loadings from the 10 municipal sewage treatment plants in Monroe County.

Professor Robert Sweeney of Buffalo State Teachers College for his study of the benthic chemistry in a report entitled "The Use of a Hopper Dredge as an Aerator and Classifier of Sediments".

Professor William Diement for data on the embayment area.

LOCATION OF SAMPLING STATIONS

The locations of eleven sampling stations chosen for this study were based on three factors 1) the lack of existing historical information, 2) accessibility of the sampling point, and 3) the necessity of obtaining a complete data set for critical stretches of the river. Efforts were also made to have some of the stations coincide with existing monitoring stations operated by the United States Geological Survey or the New York State Department of Environmental Conservation.

Sampling stations were divided into two general categories:

1. "A" stations on which full chemical and biological analyses were performed, and
2. "B" stations on which oxygen determinations were made as well as analysis for a few selected parameters such as nutrients and information needed for stream assimilation capacity calculations.

The list of parameters analyzed at each type of station is found in Appendix B of this report.

Specific justification for the selection of each sampling station is as follows (see Figure 1):

Station 1A, 2B, 3A and 4B were selected on the upper reach of the study area to obtain sufficient background information on the upper reaches of the main stem of the Genesee River and also the effects of its main tributaries Honeoye Creek, Oatka Creek, and Black Creek. Station 1A (milepoint 34.0) reflects the initial background of the Genesee River; Station 2B (milepoint 25.4) reflects the impact of Honeoye Creek; Station 3A (milepoint 21.5) reflects the impact of Oatka Creek; Station 4B (milepoint 14.7) coincides with NYSDEC Surveillance Station 04 0020 SW and is located just prior to the influent of Black Creek to the Genesee River.

Stations 5A and 6A are located 12.2 and 10.0 miles respectively, from the mouth of the Genesee River and were selected to measure the impact of the Barge Canal crossing the Genesee River. Station 6A coincides with a USGS station 01 002 located at Elmwood Bridge. NYSDEC Surveillance Stations 04 C901 and 04 C902 are located on the Erie Canal west and east of the crossing, respectively. Data from the latter two surveillance stations was readily available.

Station 7B is located 9.1 miles from the mouth of the Genesee and was chosen as the last available location prior to the point of the major combined sewer overflows in the City of Rochester. It is also located approximately one-half mile upstream from an impoundment to obtain a respresentative sample of the stream characteristics.

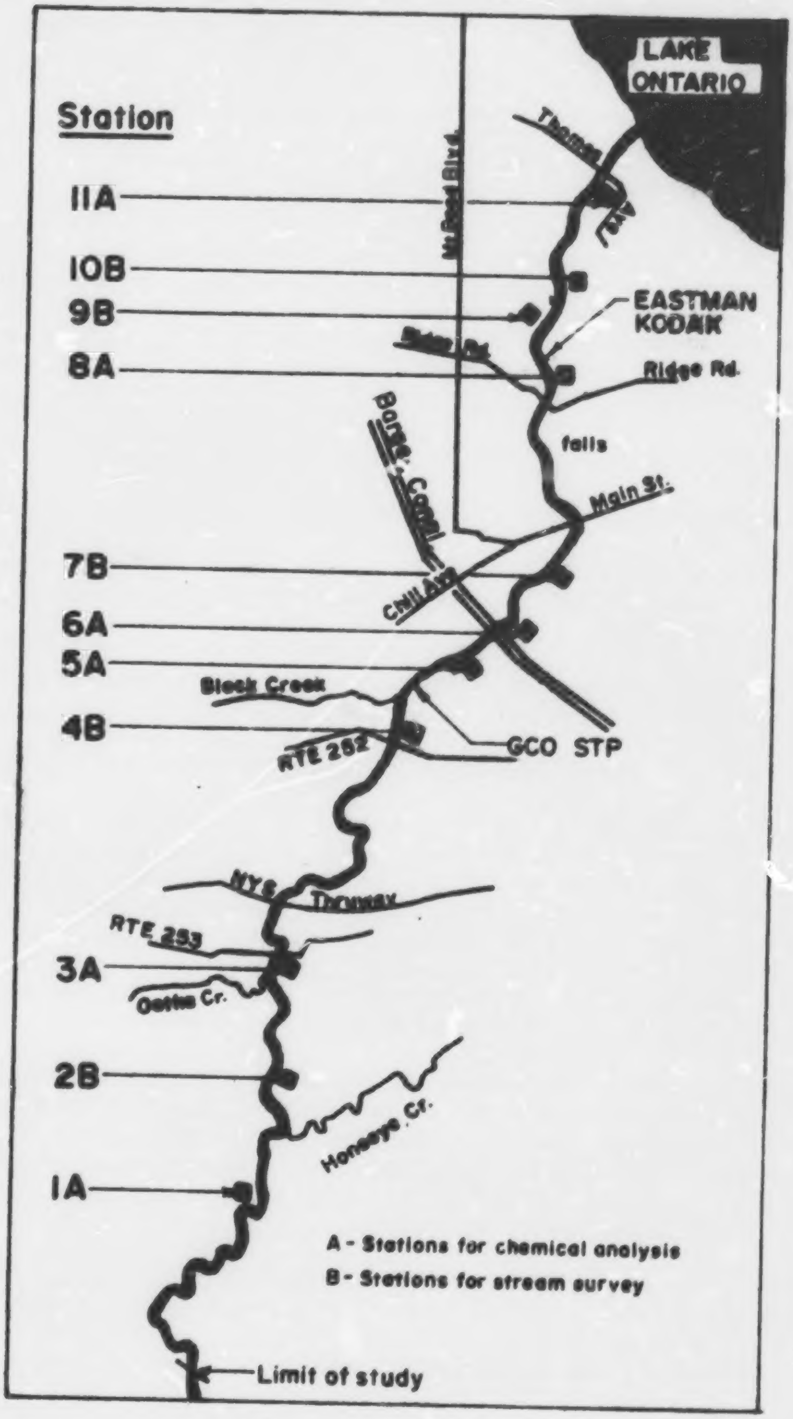

Station
11A
10B
9B
8A
7B
6A
5A
4B
3A
2B
1A
LAKE ONTARIO
Thomas Ave.
Mt. Read Blvd.
EASTMAN KODAK
Ridge Rd.
Ridge Rd.
falls
Barge Canal
Main St.
Chili Ave.
Black Creek
GCO STP
RTE 252
NYS Thruway
RTE 253
Oatka Cr.
Honeoye Cr.
A - Stations for chemical analysis
B - Stations for stream survey
Limit of study

Figure I. Sampling Stations on the Genesee River

Station 8A is located 4.7 miles from the Genesee River mouth and was chosen as the first location subsequent to the major combined sewer overflows and prior to the Eastman Kodak sewage treatment plant. This station coincides approximately with NYSDEC Surveillance Station 04 0010 SW.

Stations 9B and 10B are located 3.4 and 2.2 miles respectively, from the mouth of the Genesee River. Station 9B reflects the impact of the Eastman Kodak Treatment Plant discharge and Station 10B includes some of the impact on the stream caused by US Army Corps of Engineers' dredging activities in this area. The chemical analyses conducted on samples obtained at Station 10B reflected only minimal static, post dredging effects since no dredging activity occurred while the sampling program was being conducted.

Station 11A is located at Stutson Street Bridge approximately 0.7 miles from the mouth of the Genesee. Data collected at this point reflected intrusion of the river waters during the sampling period.

SAMPLING PROCEDURE

A specific method of sampling collection was used at each type of sampling station. At the "A" stations where full chemical and biological analyses were performed, the samples consisted of one-half gallon volumes made up by compositing grab samples taken at three different depths at a mid-stream location. The three depths chosen were at the surface, mid-depth and near the bottom of the River in order to reflect the mainstream of the river.

At the "B" stations it was desired to make measurements of dissolved oxygen concentration as well as to analyze for a number of oxygen demanding constituents. In order to obtain reasonably accurate DO readings over the entire cross section of the River, a method different from "A" was employed. Nine separate samples were collected in a grid fashion such that individual samples were taken at the quarter-points and at three different depths. Each individual sample was analyzed for dissolved oxygen, and the main stem DO at each station was determined by averaging the DO values found at these nine points on the cross-section of the River. A one-half gallon sample for chemical analysis was also collected at the "B" stations by compositing equal portions from samples taken at the nine points in the sampling grid.

An assortment of equipment was employed for sampling the river to assure the best results for each parameter The concentrated plankton samples were obtained by a vertical number 20 net haul. Fish counts were obtained through the use of gill nets. The River water samples were collected with a non-metallic Van Dorn sampling apparatus at the various locations and depths discussed previously. Temperature and pH were measured at the time of each sampling by lowering temperature and pH probes to the desired depth. Dissolved oxygen determinations were made using the azide modified idometric method.(4) DO samples were fixed immediately upon collection.

All analytical measurements were conducted in accordance with those procedures outlined in "Standard Methods" or in accordance with analytical procedures recommended by the Water Quality Office of the U.S. Environmental Protection Agency.(5)

SECTION V

CHEMICAL AND PHYSICAL CHARACTERISTICS OF THE GENESEE RIVER

TEMPERATURE

During the course of the sampling program, temperature readings at each station were made. For those stations denoted "A" (Chemical) stations, temperature readings were taken at the surface, middle, and bottom of the stream. At those stations denoted "B" (Stream Survey) stations, readings were taken at the surface, middle and bottom at (1) the center of the stream, (2) the east side of the stream, and (3) the west side of the stream. This procedure gave three readings at the "Chemical" stations and nine readings at the "Stream Survey" stations. (Figure 2 shows the averages at each station for all 8 samplings. The results of the data obtained are discussed below.)

During the first sampling period conducted July 18-19, 1973 the temperature varied from 23.0°C at Station 2 to 26.0°C at Station 10. As the distance downstream from Station 1 increased, the average river temperature at each successive station remained about the same as shown on Table 3. However, following the Genesee Falls between stations 7 and 8, a 1.3°C increase in temperature was observed. This increase may be explained by the fact that RG & E generating stations discharge cooling water in this reach. The temperature continued to increase to Station 10, where a value of 26.0°C was observed. At Station 11 the recorded temperature of 24.4°C reflects the estuarine effect of Lake Ontario on the river. The surface temperature at this station is in the same range as at the three previous stations but the bottom temperature is significantly lower by approximately 3°C. This may be the result of an estuarine effect or simply due to the increased depth of the water at this station. Similar results are seen from the data for samplings 2 and 3 conducted on August 1-2 and August 15-16, respectively.

Variation of temperature with depth is nearly negligible for the first three sampling occasions. The variations range from 0-2°C at each station indicating a good mixing action in the stream between surface and bottom waters. For example, at Station 1 the average surface temperature for the first three samplings was 23.3°C while the average bottom temperature was also 23.3°C. At Station 2 the respective surface and bottom temperatures were 24.0°C and 23.1°C. See Table 4 below.

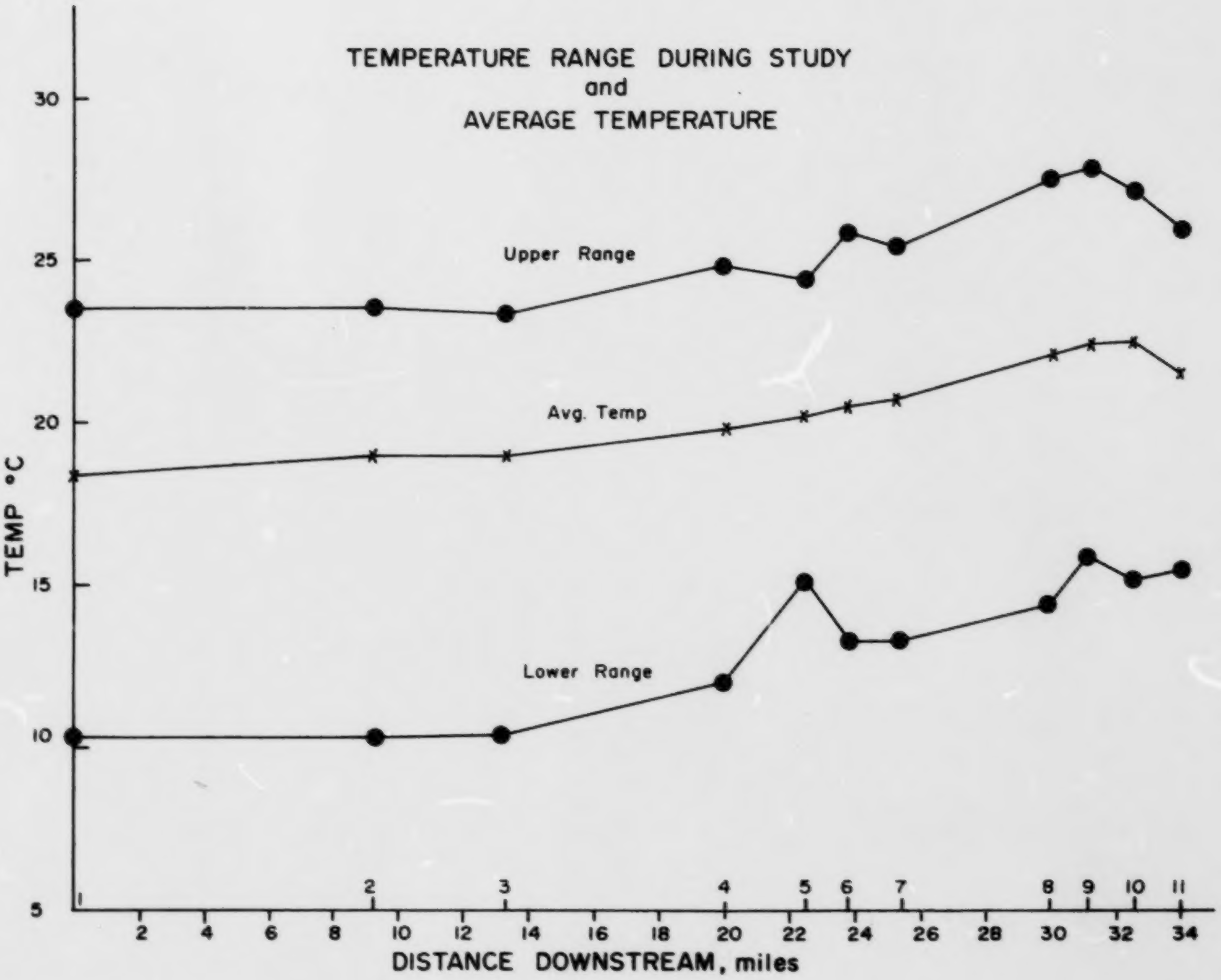


Figure 2 Temperature vs. Downstream

Table 3. Average Temperatures During Study, °C

	Sampling Date							
Sta.	July 18-19	Aug. 1-2	Aug. 15-16	Sep. 10-11	Sep. 12-13	Sep. 13-14	Sep. 26-27	Oct. 18-19
1	–	23.3	23.4	19.3	17.7	18.3	15.6	10.3
2	23.4	23.6	23.6	19.2	18.3	17.8	15.8	10.3
3	23.5	23.6	22.7	19.6	18.6	18.2	16.4	10.4
4	23.4	24.2	24.9	20.5	19.1	18.5	15.4	12.0
5	23.3	23.8	24.5	20.5	19.6	18.4	16.0	15.2
6	23.9	25.1	25.9	21.1	20.5	19.2	15.3	13.2
7	24.0	24.7	25.4	21.2	20.6	–	15.7	13.3
8	25.3	26.6	27.6	23.1	21.7	–	16.3	14.3
9	25.9	24.9	27.9	23.5	22.6	–	16.7	15.9
10	26.0	25.9	27.2	23.5	22.8	–	17.3	15.3
11	24.4	22.9	26.0	23.2	22.9	–	15.8	15.5

Table 4. Average Temperatures for First Three Samplings, °C

Station	Surface Temp	Bottom Temp	Difference
1	23.3	23.3	0.0
2	24.0	23.1	0.9
3	23.8	22.6	1.2
4	24.7	23.7	1.0
5	24.5	23.3	1.2
6	25.5	24.3	1.2
7	25.1	24.4	0.7
8	27.1	25.8	1.3
9	27.3	24.0	3.3
10	27.0	24.1	2.9
11	26.8	21.9	4.9

In the lower reaches (Stations 8 through 11) the difference in temperature between the surface and the bottom of the stream becomes greater due to a combination of increased depth of the stream and the effect of Lake Ontario waters on the Genesee River.

During the week of September 10 to September 14, a concentrated sampling effort was conducted. The temperature data gathered showed an overall average reduction in stream temperature at each station of about 3-4°C from the preceding 3 samplings, most likely due to the onset of colder weather in the basin.

Table 5. Average Temperatures of Samplings 4, 5, & 6 - °C

Station	Surface Temp	Bottom Temp	Difference
1	18.4	18.4	0.0
2	18.4	18.4	0.0
3	15.5	15.5	0.0
4	19.8	18.7	1.1
5	19.5	19.4	0.1
6	20.5	19.8	0.7
7	21.0	20.7	0.3
8	22.7	22.1	0.6
9	23.5	22.7	0.8
10	23.4	22.6	0.8
11	23.0	22.9	0.1

Table 6. Average Temperatures for Samplings 7 & 8, °C

	7			8		
Station	Surface	Bottom	Difference	Surface	Bottom	Difference
1	15.6	15.6	0.0	10.3	10.3	0.0
2	15.8	15.8	0.0	10.4	10.4	0.0
3	16.4	16.4	0.0	10.5	10.4	0.1
4	15.5	15.3	0.2	12.1	10.9	1.2
5	16.4	15.8	0.6	15.2	15.2	0.0
6	15.4	15.2	0.2	13.2	13.2	0.0
7	16.2	15.2	1.0	13.4	13.4	0.0
8	16.5	16.2	0.3	14.3	14.3	0.0
9	16.8	16.5	0.3	15.9	15.6	0.3
10	17.7	17.2	0.5	15.5	15.2	0.3
11	18.3	12.5	5.8	15.6	15.3	0.3

Sampling number seven, conducted September 26-27, showed a drop of overall stream temperatures of between 3 to 4°C from the September 10-14 samplings (Table 5), again probably due to colder weather in the basin. Station 11 is the station exhibiting the greatest difference in temperature between the surface waters and bottom waters due to the estuarine effect of Lake Ontario.

Sampling No. 8, October 18-19, showed little or no difference in surface and bottom temperatures at all eleven stations (See Table 6).

DISSOLVED OXYGEN

During the collection of samples, dissolved oxygen measurements were made at the eleven sampling stations. As in the case of temperature measurements, three readings were taken at each of the "Chemical" stations at the surface, mid-depth, and stream bottom. At the "Stream Survey" sampling stations dissolved oxygen measurements were made in a grid fashion with samples taken at the surface, mid-depth and stream bottom in (1) the middle of the stream, (2) east side of the stream, and (3) the west side of the stream. Figure 3 shows a plot of the average values of DO versus distance downstream for all 8 samplings.

As can be seen from Table 7, the dissolved oxygen normally decreased in concentration as a function of distance traveled downstream from Station 1. This can be expected since the loading to the river increases as the river approaches the more urban areas south of Rochester and enters the City of Rochester. On all but one sampling date, the DO increased to its highest levels just prior to the discharge of the Gates-Chili-Ogden STP to the Genesee River. From this point (Station 4) and continuing downstream, the DO decreases as the river picks up both stormwater overflows and/or dry weather flow from the combined sewer overflow network in the City of Rochester. There is also a large contribution to the organic loading from the parks and from the Kodak Wastewater Treatment Plant as well as from the Barge Canal.

Coincidental with the increase in oxygen demand is an increase in water temperature.

Table 7. Average Dissolved Oxygen, mg/l

Sta.	July 18-19	Aug. 1-2	Aug. 15-16	Sep. 10-11	Sep. 12-13	Sep. 13-14	Sep. 26-27	Oct. 18-19
1	–	9.7	6.9	7.3	–	7.1	8.7	7.3
2	10.6	8.8	7.5	7.3	7.3	6.7	8.4	7.2
3	10.9	8.6	7.4	7.5	7.6	7.4	7.8	7.0
4	11.3	8.6	7.8	7.6	7.6	7.6	8.1	7.6
5	12.1	8.3	3.7	6.2	5.5	6.1	7.5	7.8
6	10.3	6.9	7.2	6.2	6.4	5.8	9.3	8.3
7	8.3	8.5	7.5	5.9	6.1	–	7.4	8.9
8	7.6	5.5	6.3	6.8	6.2	–	8.8	8.9
9	5.8	4.9	7.2	5.9	6.0	–	8.0	8.9
10	5.0	4.5	3.4	5.4	5.3	–	8.1	6.8
11	6.0	3.9	4.3	5.1	4.1	–	8.7	6.2

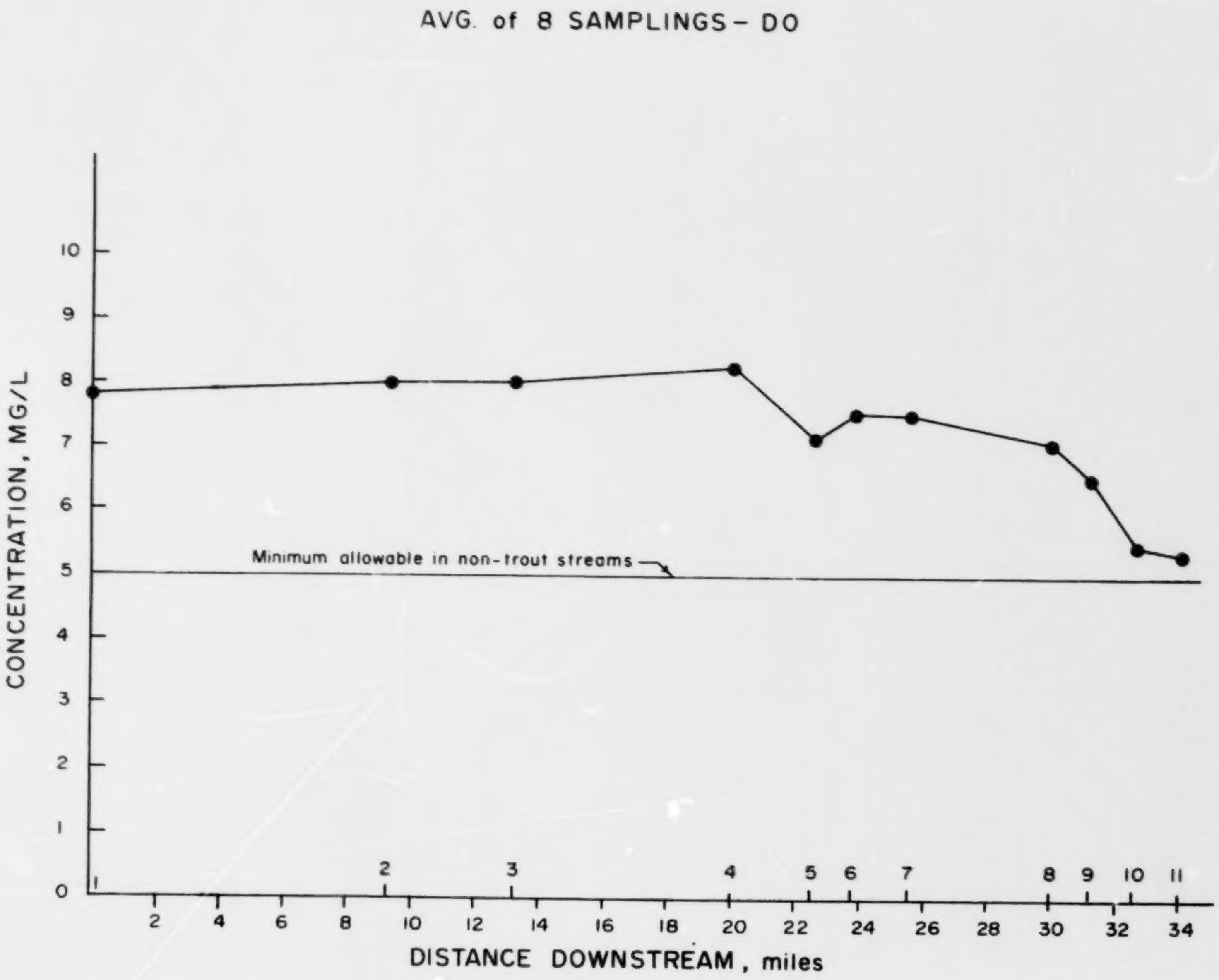

AVG. of 8 SAMPLINGS - DO

Figure 3 Dissolved Oxygen vs. Distance Downstream Study

This causes an additional reduction on the already depressed dissolved oxygen conditions.

In the first three samplings a considerable variation in DO with respect to depth was observed as seen in Table 8. No pattern is evident from either station to station or sampling to sampling. In general, the greater the depth, the lower the DO at each station. This would tend to indicate that the stream is not as well mixed as was indicated by the temperature data. Station 8 appears to be the station most nearly well-mixed which was to be expected since it is located after the falls. At this station the average DO of the surface water is 7.3 mg/l while the bottom wasters average 5.7 mg/l for an average difference of 1.6 mg/l. At station 11 where some intrusion of Lake Ontario waters is expected, the average DO of the surface waters was 5.8 mg/l and the average bottom DO was 2.5 mg/l for an average difference of 3.3 mg/l. Between Stations 5 and 6 the DO at the river bottom is higher with respect to the surface waters than at the previous stations. The confluence of the Barge Canal with the Genesee River represented by Station 6 provides some mixing action but more importantly reflects the predominant influence of the canal.

Table 8. Average DO for Samplings 1, 2 & 3, mg/l

Sta.	Surface	Bottom	Difference	Surface	Bottom	Difference	Surface	Bottom	Difference
1	–	–	–	9.3	9.6	-0.3	7.4	6.1	1.3
2	13.4	8.8	4.6	10.5	7.0	3.5	7.6	7.0	1.6
3	13.6	8.6	5.0	10.4	7.2	3.2	8.5	6.8	1.7
4	13.4	9.6	3.8	10.6	7.3	3.3	9.0	1.6	7.4
5	14.7	8.9	5.8	12.3	6.2	6.1	8.9	0.8	8.1
6	10.9	9.3	1.6	7.8	6.0	1.8	8.8	4.7	4.1
7	10.1	6.1	4.0	9.6	7.0	2.6	7.0	4.4	2.6
8	8.1	7.2	0.9	6.0	4.5	1.5	7.9	5.3	2.6
9	6.1	5.0	1.1	6.1	0.3	5.8	7.5	2.5	5.0
10	5.1	4.0	1.1	4.0	2.1	1.9	4.0	1.3	2.7
11	8.0	3.2	4.8	4.8	2.1	2.7	4.5	4.5	0.0

During the concentrated sampling effort, September 10-14, Table 9 the grid method of DO measurements was used for all stations to determine the average DO of the stream. The data from these samplings indicate that the river water was well mixed as indicated by the small difference in DO level between surface and bottom samples.

Table 9. Average DO's for Samplings 4, 5 & 6, mg/l

Sta.	Surface	Bottom	Difference	Surface	Bottom	Difference	Surface	Bottom	Difference
1	7.8	7.2	0.6	7.1	7.0	0.1	7.2	7.0	0.2
2	7.4	7.0	0.4	7.6	6.5	1.1	6.6	6.6	0.0
3	7.7	7.5	0.2	7.5	7.5	0.0	7.3	7.2	0.1
4	7.4	7.5	0.4	7.9	7.9	0.0	8.8	6.7	2.1
5	7.0	5.0	2.0	6.0	5.5	0.5	6.3	5.8	0.5
6	6.3	6.2	0.1	7.3	5.9	1.4	6.2	5.6	0.6
7	6.3	5.2	1.1	7.0	5.5	1.5	–	–	
8	7.8	6.0	1.8	6.4	6.2	0.2	–	–	
9	6.0	5.6	0.4	6.2	5.8	0.4	–	–	
10	6.7	6.1	0.6	5.5	5.0	0.5	–	–	
11	5.4	5.0	0.4	4.5	4.1	0.4	–	–	

Table 10 shows the DO's of surface and bottom waters for samplings 7 and 8. As in samplings 4, 5 and 6, the data indicates that the river is well mixed with respect to DO.

In all cases the average DO's (Table 7) show that the stream is within the DO qualifications necessary to meet the "B" stream standards set by NYSCEC at 5.0 mg/l for non-trout waters.(6)

Table 10. Average DO's of Samplings 7 & 8, mg/l

	7			8		
Station	Surface	Bottom	Difference	Surface	Bottom	Difference
1	8.7	8.7	0.0	8.0	6.3	1.7
2	8.9	8.8	0.1	7.7	7.6	0.1
3	7.8	7.7	0.1	8.1	7.7	0.4
4	8.0	8.1	-0.1	7.5	7.5	0.0
5	7.6	7.5	0.1	7.5	7.8	-0.3
6	9.5	9.0	0.5	8.6	7.7	0.9
7	7.8	6.5	1.3	9.5	8.6	0.9
8	8.8	8.8	0.0	9.3	8.5	0.8
9	8.1	8.0	0.1	9.5	8.6	0.9
10	8.1	7.8	0.3	7.1	6.8	0.3
11	8.9	8.4	0.5	6.4	6.0	0.4

NITROGEN COMPOUNDS - AMMONIA NITROGEN, ORGANIC NITROGEN AND NITRATE NITROGEN

The plots of NH_3N, OrgN and NO_3N concentrations as a function of river mileage are shown on Figures 4 and 5. These plots show increasing concentrations of NH_3N as a function of river mileage, fluctuating OrgN concentrations and relatively constant NO_3N concentrations.

The NH_3N concentration is at a relatively low level, 0.03 ppm, at the first station and remains nearly constant with only a slight increase to a value of 0.04 ppm at Station 3. The Avon municipal sewage treatment plant discharges to the Genesee River approximately 0.3 miles downstream of Station 1 which would account for the increase in concentration of all three parameters at Station 2. From Station 2 to Station 3 the OrgN concentration decreased from a value of 0.43 ppm at Station 2 to 0.20 ppm at Station 3 as it is hydrolyzed to NH_3N. The NH_3N decreased in value from 0.6 ppm to 0.04 ppm in the same reach as it is oxidized from NH_3N to NO_3N. The conversion of OrgN to NH_3N occurs faster than the conversion of NH_3N to NO_3N, as indicated on the plot.

From Station 3 to Station 4, where significant non-point source contribution occurs from agricultural activity, the NH_3N value increased from 0.04 to 0.17 ppm. In addition, the conversion of OrgN to NH_3N contributes to this increase. The NO_3N showed a very small change in concentration, remaining at 0.15 ppm in the reach. No major point source discharges occur in this reach so it is likely that the changes in concentration of all three parameters is a result of non-point source contributions or the interconversion of nitrogen from one form to another.

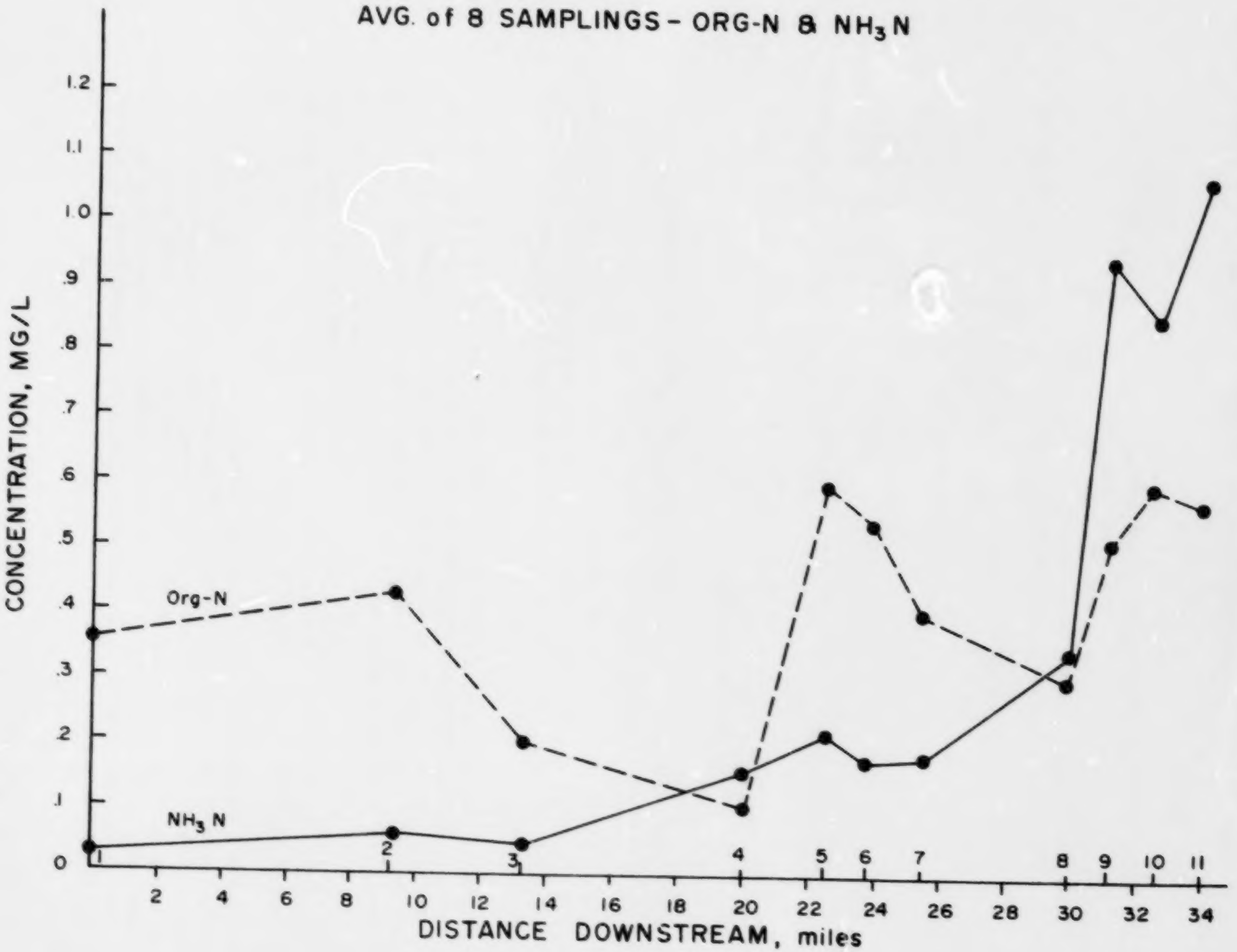


Figure 4 Org-N and NH_3 (N) vs. Distance Downstream During Study

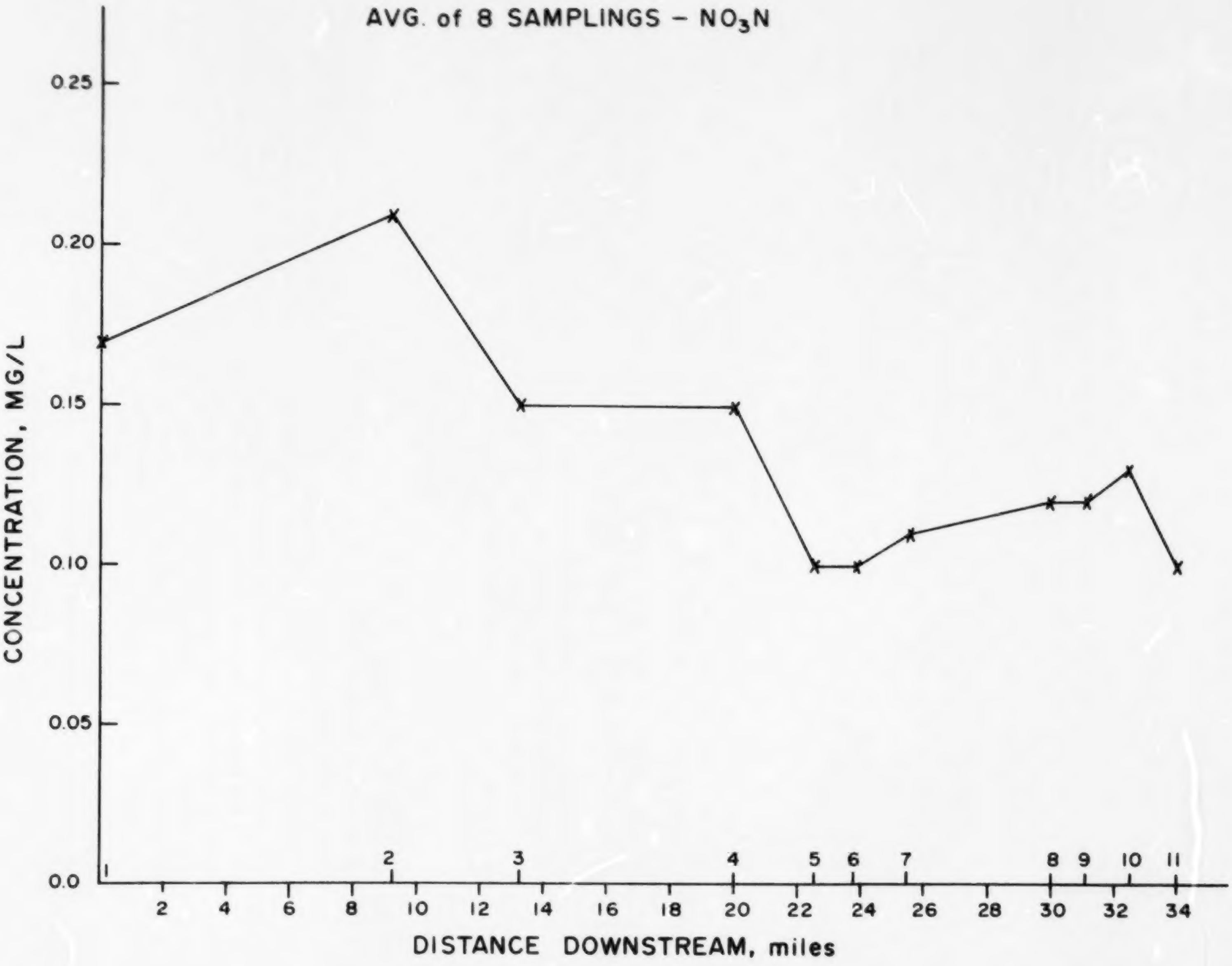


Figure 5 NO¾(N) vs. Distance Downstream During Study

Black Creek and the Gates-Chili-Ogden Sewage Treatment Plant discharge to the river between Stations 4 and 5. Most of the increases in concentration in nitrogen species in this reach are due to the latter discharge. Both NH_3N (0.17 ppm to0.22 ppm) and OrgN (0.11 ppm to 0.60 ppm) concentrations increased greatly in this reach. The concentration of NO_3N actually decreased due to the dilution effect of Black Creek while at the same time little conversion of NH_3N to NO_3N was occurring.

From Station 5 to Station 6, the Erie Canal crosses the Genesee River and has a slight dilution effect on the River waters. The concentrations of NH_3N and NO_3N decreased slightly over this reach. From Station to Station 7, OrgN is converted to NH_3N and the concentration drops from 0.54 ppm to 0.40 ppm causing an increase in NH_3N and raising the value of NO_3N from 0.10 to 0.11 ppm.

The concentrations of the nitrogen species remained relatively unchanged between Stations 7 and 8: OrgN from 0.40 to 0.30 ppm, NH_3N from 0.18 to 0.34 ppm and NO_3N from 0.11 to 0.12 ppm. As the OrgN concentration decreased the NH_3N concentration increased. Some contribution to the River occurs in this reach as a result of the discharge of dry-weather and/or runoff from the Rochester stormwater overflow sewerage system. The contribution of these overflows to the pollution load on the Genesee will be discussed later in this report.

Immediately downstream from Station 8, in the vicinity of the Kodak Sewage Treatment Plant the concentration of OrgN increased from 0.30 to 0.52 ppm while the NH_3N increased from 0.34 to 0.95 ppm in this reach. The Kodak discharge is high in OrgN (8.9 ppm)(85) which appears to be largely converted to NH_3N in this reach, since NH_3N is converted to NO_3N.

The reach from Station 9 to Station 10 showed little change in concentration of the three parameters in that stretch although OrgN increased slightly and NH_3N decreased slightly.

From Station 10 to Station 11 OrgN decreased slightly from 0.60 to 0.57 ppm while NH_3N increased from 0.86 ppm to its highest value at 1.07 ppm. Irondequoit North-St. Paul Sewage Treatment Plant discharges to the Genesee very near Station 11. This may account for the high NH_3N values at this station although the estuarine effect of Lake Ontario may also play a role here.

pH

The pH of the Genesee River generally remained in the range of 7.0 to 8.4 throughout the course of the sampling program. Average values of pH for the eight samplings conducted showed that the pH did not drop below 7.0 nor exceed 8.3 during the study. The pH showed no consistant variation from the upstream stations to the downstream stations throughout the study. On the third sampling, the pH did rise to as high as 8.7 at Station 8 and all stations showed a somewhat higher pH than the averages compiled of all samplings. At the time of the third sampling the pH exceeded the pH limitation of 8.5 as required by the NYSDEC Water Quality Standards of July 1973. Over the course of the entire study, the average pH did remain within the limitation of 6.0 - 8.5 as set by the NYSDEC. Under most conditions the pH approached the upper limit.

As can be seen on the plot of pH versus river mileage on Figure 6, the average pH dropped only slightly with distance downstream, the stations below the Falls exhibiting the lower pH's.

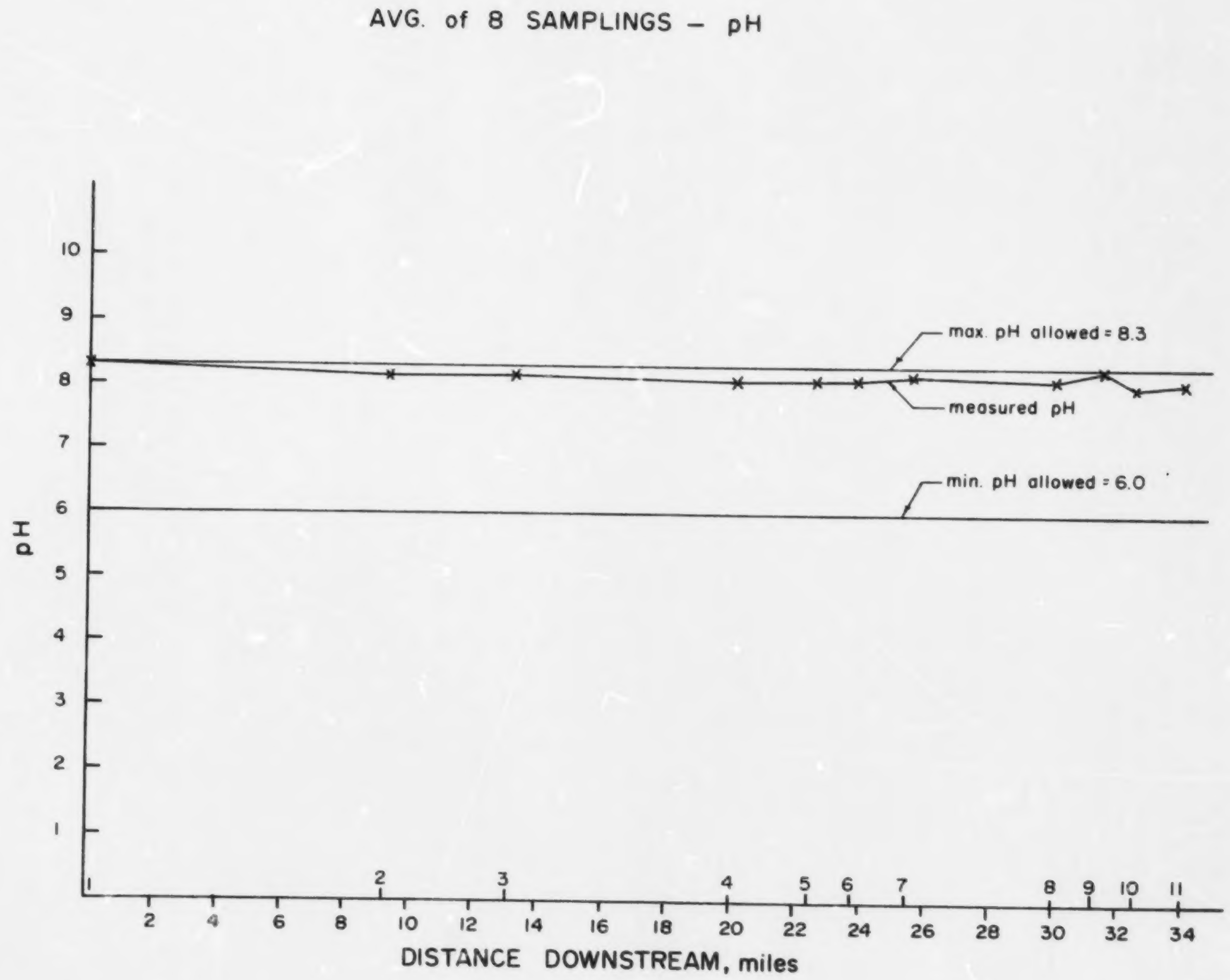


Figure 6 pH vs Distance Downstream During Study

BIOCHEMICAL OXYGEN DEMAND

The Biochemical Oxygen Demand (BOD) remained at the same order of magnitude throughout the sampling period at each of the eleven stations, although the BOD did fluctuate from station to station during individual sampling runs. Average BOD values for all eight samplings showed the BOD ranging from a minimum value of 2.0 mg/l at the upstream stations to a maximum average value of 3.6 mg/l at the downstream stations. This is consistent with the loadings to the river increasing as the river approaches and progresses through the City of Rochester.

As can be seen from the plot of BOD on Figure 7, the concentration of BOD increases significantly from Station 2 to Station 5. Since the major discharges in this region are the tributaries Honeoye Creek and Oatka Creek, the increased loading is due to non-point source contributions from the agricultrual areas adjacent to the Genesee River as well as from municipal and industrial sources on both Honeoye Creek and Oatka Creek.

From Stations 5 to 6 the BOD remains at an average value near 3.0 mg/l. Between these two stations the Barge Canal contributes approximately 242 million gallons per day to maintain the river level for navigational and electrical power generation purposes. No drop in BOD is evident at Station 6 since the diverted canal water follows the west bank of the Genesee River for a short distance before it becomes well mixed with the river water. Thus the effect of the canal water in diluting the BOD of the river does not appear until measurements are taken at Station 7 where a decrease in BOD from 3.0 mg/l to a value of 2.5 mg/l occurs. BOD reflects suspended matter as well as dissolved matter and while the river appears to be well-mixed with respect to DO at Station 6, an extended distance to Station 7 is necessary for the suspended matter to be thoroughly mixed in the river and to reflect BOD.

From Station 7 to Station 8 the BOD again increased due to the additional loading of the combined sewer overflow system which contributes BOD in the form of wet-weather and/or dry-weather flows. The increase in BOD continues to Station 9 as a result of the discharge of the Kodak Sewage Treatment Plant effluent just subsequent to Station 8. Also along this stretch of the River a considerable amount of natural non-point source BOD can be expected from Seneca Park located along the River.

From Station 9 to Station 11 the BOD begins to decline due to the natural assimilation capacity of the River and also due to the estuarine effect caused by the waters of Lake Ontario. In the vicinity of Station 11, a municipal treatment plant discharge (Irondequoit North-St. Paul STP) occurs. The BOD values at Station 11 for the 8 samplings vary at random from 0.9 mg/l to 6.2 mg/l. This effect may be caused by the influence of Lake Ontario in dispersing or failing to disperse the Genesee River flow depending on local weather conditions at the time of sampling. Also there is considerable river traffic of freighters and recreational watercraft between the mouth of the Genesee and the Genesee Docks which might increase the longitudinal mixing of the river resulting in an increased dispersion of the effluent from the Irondequoit North-St. Paul Treatment Plant.

Sampling number 4 produced BOD values that were lower than the overall averages at all stations. At no stations did the BOD exceed 1.6 mg/l during this sampling.

Occasionally BOD "spikes" occurred for unexplained reasons. This is evidenced on July 18-19 at Station 3, September 12-13 at Stations 6 and 7, and September 13 and 14 at Station 4.

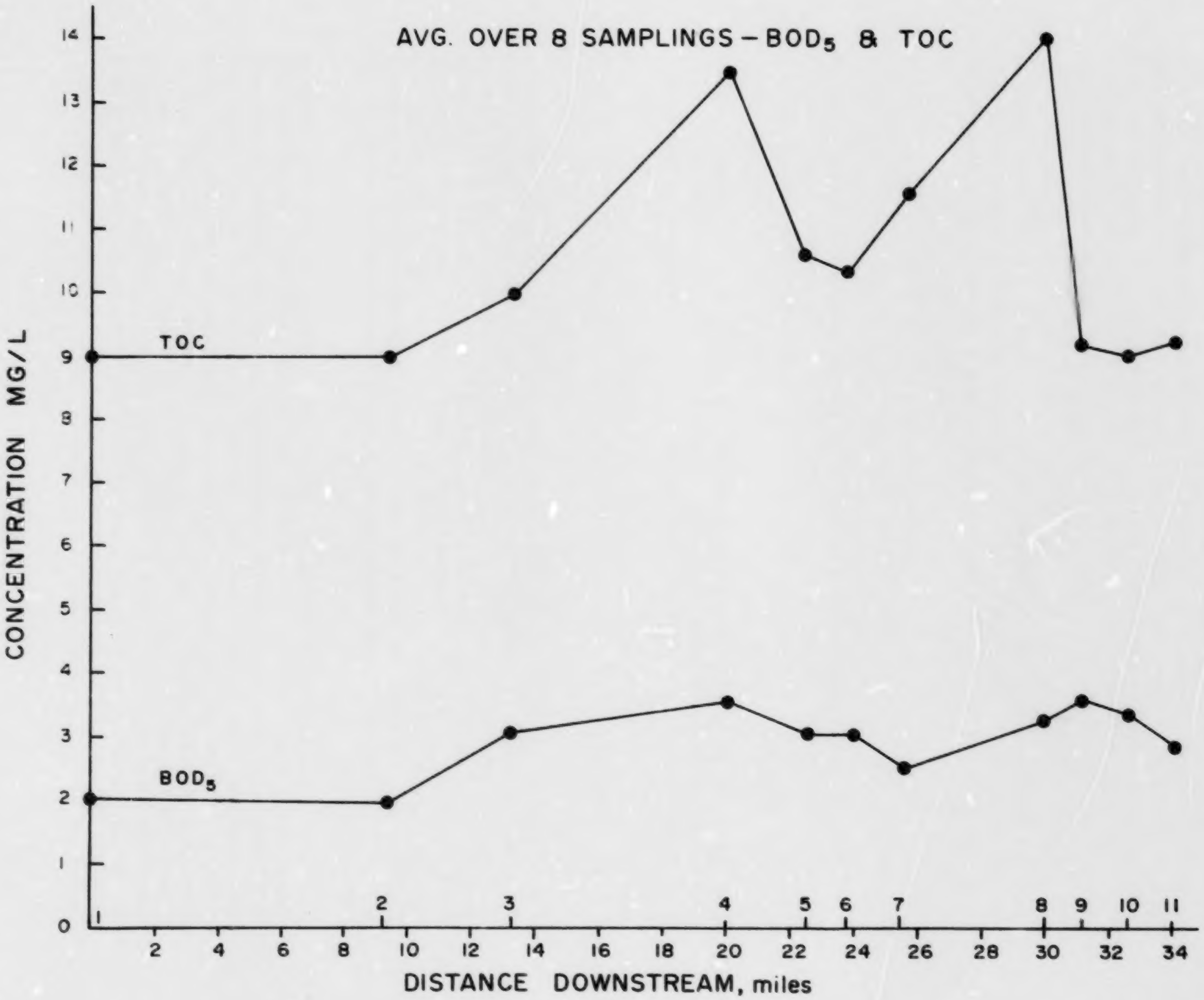


Figure 7 BOD$_5$ and TOC vs. Distance Downstream During Study

TOTAL ORGANIC CARBON (TOD)

The concentration of Total Organic Carbon varied in much the same manner as the BOD. From the plot of BOD and TOC concentrations as a function of river mileage (Figure 7) it is seen that the two parameters are co-variant. As the TOC concentration increased the BOD concentration also increased. At Stations 1 and 2 the shape of the curve remains essentially constant. As the BOD increased from Station 2 to Station 3, the TOC curve also increased. A similar effect is observed from Station 3 to Station 4 and along the entire sampling network. It may be pointed out that the concentration of TOC declines sharply from **Station 8 to Station 9 although the measured BOD is not as responsive. This sharp** reduction in TOC might be explained by the sedimentation of a component of the industrial non-degradeable TOC into the benthos in this comparatively quiescent stretch of the river without a corresponding decline of BOD. The presence of a toxic or retarding environment created by the industrial discharge in this reach could be a minor factor producing this reduction of TOC.

CHLORIDES

The average chloride concentration measured at the eleven sampling stations over a period of eight samplings was calculated to be 91 mg/l. A plot of the average concentrations at each station as a function of river mileage is shown on Figure 8. The complete data listing is contained within Appendix B.

The values of the average concentrations of chloride measured at the various sampling stations during the study period was quite variable exhibiting a range of 64 mg/l to 139 mg/l. However, there is a general tendency for the chloride concentrations to decrease as a function of river mileage, declining from a value of 139 mg/l at Station 1 to a value of 82 mg/l at Station 7. Subsequent to Station 7 and downstream of the falls, the chloride average concentration levels off at a value between 64-66 mg/l from Station 8 to Station 11.

The loading of chlorides to the River from municipal waste treatment plants is not significant. At Avon, the chloride concentration in the Avon Municipal Treatment Plant discharge was measured at 68.9 mg/l. The concentration of chloride in the River between Station 1 and Station 2 was observed to drop from 139 mg/l to 100 mg/l. However, since the flow volume of the Avon treatment plant is only 1 MGD as compared to an average river flow rate of 214 MGD, it is improbable that a drop of 39 mg/l of chloride between Stations 1 and 2 is caused by the Avon plant discharge. Although no actual measurements were made, a more likely possibility is the diluting effect of groundwater infiltration in this reach.

The Gates-Chili-Ogden Sewer Treatment Plant discharges to the Genesee River between stations 4 and 5 at a flow rate of 11.9 MGD. The chloride concentration of this discharge was measured at 122.4 mg/l. At Station 4 the chloride concentration averaged 81 mg/l over eight samplings while Station 5 averaged 126 mg/l, a difference of 45 mg/l. Again the comparison of flow rate and chloride concentration of the treatment plant discharge to the River flow rate and chloride concentration can not account for the 45 mg/l increase between the two sampling stations. On a strictly numerical basis, the chloride concentration of the River might be expected to increase approximately 7 per cent from 81 mg/l to 87 mg/l as a result of the treatment plant discharge. Groundwater exfiltration could be a predominant factor in chloride concentration variability.

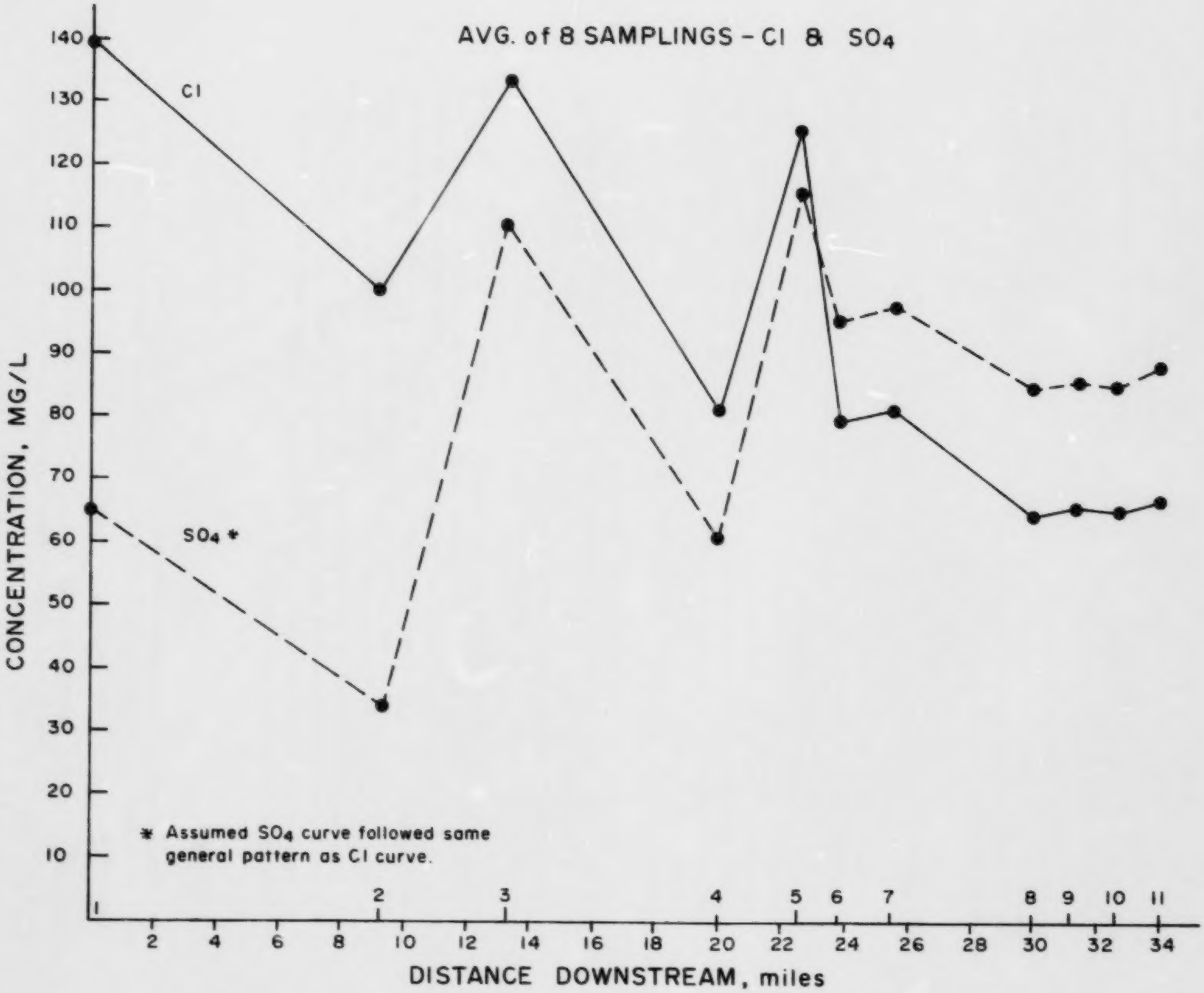


Figure 8 Cl^- and $SO_4^=$ vs. Distance Downstream During Study

The Oatka Creek, Honeoye Creek and Black Creek tributaries also tend to have little effect on the chloride concentration of the Genesee River. This is expected since the flow rate of the creeks are small in comparison to the River flow rate. In addition, data from the NYSDEC Surveillance Network indicate that the chloride concentrations of the creeks are low in comparison to the River, (Oatka Creek-46.4 mg/l, Honeoye Creek - 30.5 mg/l, and Black Creek - 49.0 mg/l). Examination of the Barge Canal sampling data shows about the same chloride concentrations as do the creeks.

As can be seen on Figure 8, the chloride concentrations tend to level off at a constant value from Station 8 to Station 11, probably due to the diffusion effects of Lake Ontario and the reduced loading in this lower section. The chloride concentration varies from 64-66 mg/l in the lower section.

SULFATES

The average concentration of sulfate measured at the six chemical stations over eight samplings was determined to be 95 mg/l. A plot of the average concentrations measured at each sampling station as a function of river mileage is shown on Figure 8. The complete data listing is contained in Appendix B.

As can be seen from Figure 8, the concentration of sulfate followed the same pattern as the previously discussed chloride concentrations. Although actual measurements were not made at the five biological stations, the data obtained at the six chemical stations exhibited the same trend as the chloride data. Thus the values of sulfate as shown on Figure 8 at the five biological stations was interpolated to follow the same general curve.

The range of sulfate concentrations measured at the six sampling stations varied from 122 mg/l to 65 mg/l. The average values at each station over the eight samplings tended to stabilize at a value of 84-88 mg/l at Stations 8 through 11. In this lower section, the relatively constant sulfate concentration is most probably due to the dispersion effects of Lake Ontario and the lack of any significant additional inputs.

Examination of the data obtained by the NYSDEC Surveillance Network for the main tributaries to the Genesee River show relatively high sulfate concentrations in Oatka Creek (168.0 mg/l), Honeoye Creek (230.0 mg/l) and Black Creek (273.0 mg/l) while the sulfate concentrations for the Barge Canal are relatively low (59.2 mg/l). Since flow volumes of the creeks are minor compared to the River flow volume, the effect of the tributaries upstream of the Barge Canal is slight. However, since the Barge Canal does contribute a major portion of the flow volume to the River, its contribution was examined. The sulfate concentrations at Station 5 were measured at 113 mg/l and at Station 6, 96 mg/l, for a difference of 17 mg/l. On a strictly numerical basis, the Canal is shown to be responsible for 75 per cent of the decrease in sulfate concentration by dilution.

FLUORIDES

The average fluoride concentration measured at the six chemical stations over a period of eight samplings was found to be 0.05 mg/l. The complete data listing is contained in Appendix B.

Examination of the fluoride data in Appendix B shows a high variability of fluoride concentrations as a function of sampling frequency and station location, ranging from 0.00 mg/l to a high of 0.70 mg/l as measured at Station 3 on October 19, 1973. However, no detectable level of fluoride could be measured on other sampling dates.

These variations with respect to sampling time and location make it impractical to draw conclusions concerning fluoride levels and effects on the River quality. Although the average fluoride concentration of the River was found to be 0.05 mg/l it should be pointed out that of 35 measurements taken during the sampling program, 24 samples showed no fluoride present in the River.

Fluoride concentrations in municipal waste treatment discharges were measured and found to be:

Irondequoit-North St. Paul	0.49 mg/l
Gates-Chili-Ogden	0.59 mg/l
Avon	0.11 mg/l

These discharges resulted in no consistent measurable fluoride concentrations in the River downstream of the individual discharges.

CYANIDES

The average cyanide concentration measured at the six chemical sampling stations over the span of eight samplings was found to be 0.04 mg/l. Of the 30 samples that were analyzed for CN during the sampling program, eighteen samples showed no cyanide present in the River.

As was the case with fluorides, a high variability in cyanide levels was observed at each sampling station. The highest level of cyanide was measured at Station 5 at a value of 0.30 mg/l. However, on other sampling occasions, the cyanide level at Station 5 was found to be zero. The wide variations in cyanide levels make it impractical to draw conclusions concerning effects of cyanide concentrations on the Genesee River.

On August 2, 1973, a fish kill was observed near Station 9. Analysis of a sample taken in the vicinity of the kill showed a cyanide concentration of 4.30 mg/l, a concentration severely toxic to aquatic life. On the same day, the cyanide concentration at Station 11 near the mouth of Lake Ontario was found to be 0.10 mg/l. The fish kill appeared to be a local effect.

PHENOLS

The average phenol concentration measured at the six chemical sampling stations over a period of eight samplings was found to be 0.038 mg/l. A plot of the average concentrations at each station as a function of river mileage is shown on Figure 9. Of thirty-four samples analyzed for phenols, fourteen showed zero phenols present in the sample. The values of phenol concentrations varied from a low of 0.00 mg/l to a one-time value of 0.550 mg/l which occurred on October 18, 1973 as station 5. Phenol analysis at Station 6 on the same date showed no unusually high phenol concentrations (0.050 mg/l). This indicates a localized effect on this date.

Examination of the phenol data collected shows no consistent trend of phenol concentration but rather great variability at each station as well as variability with respect to sampling station location. The average values of phenol concentrations vary from 0.015 mg/l at Station 1 to 0.097 mg/l at Station 5.

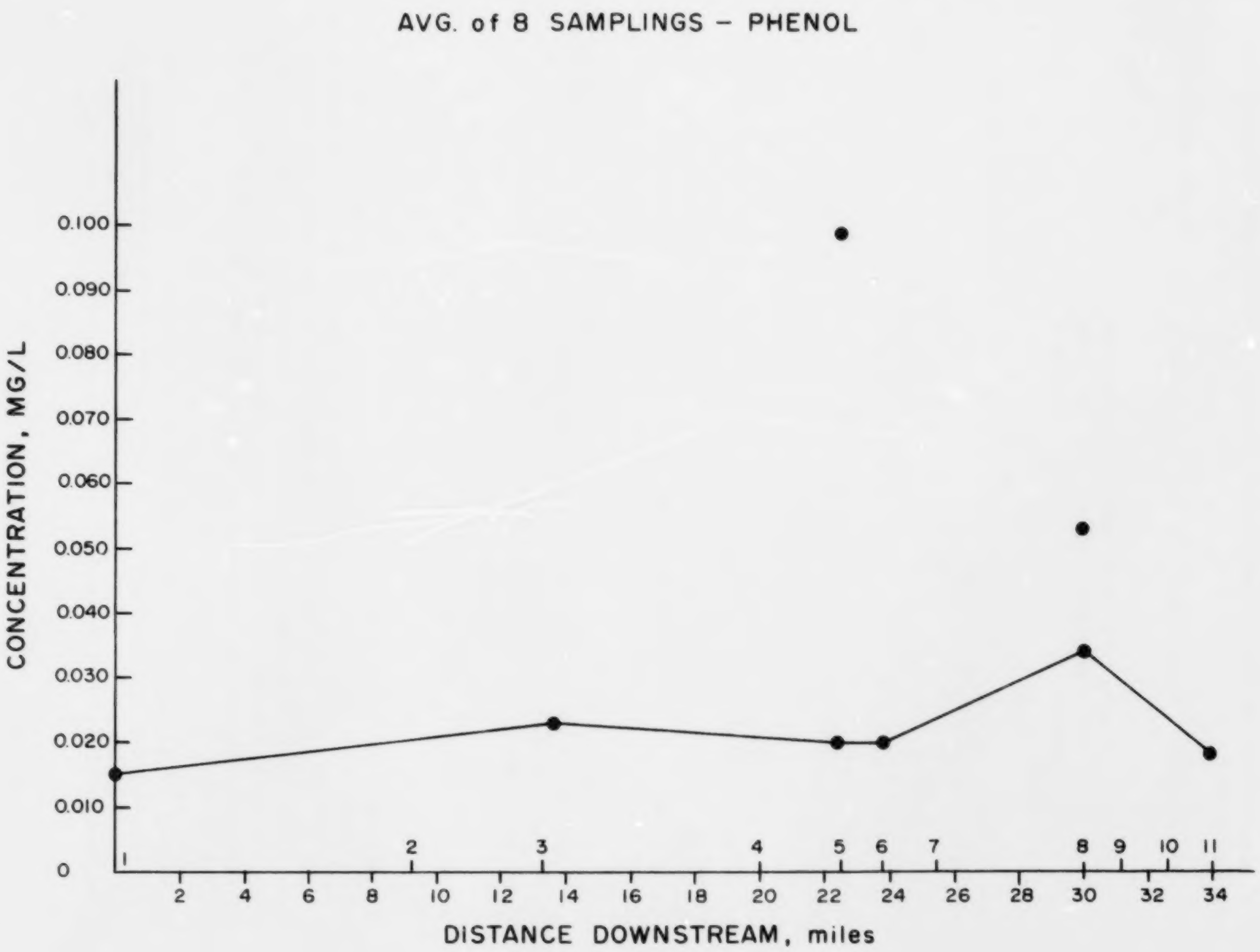


Figure 9 Phenol vs Distance Downstream During Study

Analyses for phenol concentrations were conducted on the effluent from three municipal treatment plants and resulted in the following:

Irondequoit-North St. Paul	0.0130 mg/l
Gates-Chili-Ogden	0.0220 mg/l
Avon	0.0009 mg/l

The effects of the discharges listed above on the River are expected to be minimal because of the low flow volumes of the plants' discharges with respect to the River flow. Kodak Treatment Plant data indicates an average phenolic discharge of 0.053 mg/l.

COPPER

The average concentration of copper measured at the six sampling stations over a period of eight samplings was found to be 0.034 mg/l. A plot of the average concentrations as a function of river mileage is shown in Figure 10. The complete data listing is contained within Appendix B.

The sources of copper to the Genesee River within the study area are as follows:

Municipal Point Sources	lbs/day
GCO	32.10
Avon	0.39
Irondequoit	1.04/33.53
Municipal Non Point Sources (Combined Sewer Overflows)	lbs/day
Dry Weather:	15 mgd x 0.1 ppm = 12.4
Wet Weather:	115 mgd x 0.1 ppm = 95.4
Industrial Point Sources	lbs/day
Eastman Kodak	104.4
Bausch & Lomb	62.0
RG & E	48.8/215.2

This compares to the study average concentration of Cu measured at Station 9 of 0.031 mg/l and an average flow over the sampling period of 768 MGD yielding an average poundage of 215 lbs. The mass balance between sources and measurements made within the Genesee River balance quite well even though there are a number of anticipated sinks within the system. Among the most significant sinks are likely to be those associated with the adsorption and ion exchange of soluble copper to suspended clays and alumino silicates, and their attendant settling and incorporation into the sediments. Furthermore a significant portion of the copper may at the present time be introduced in the form of particulate matter which is again incorporated as part of the bottom sediments.

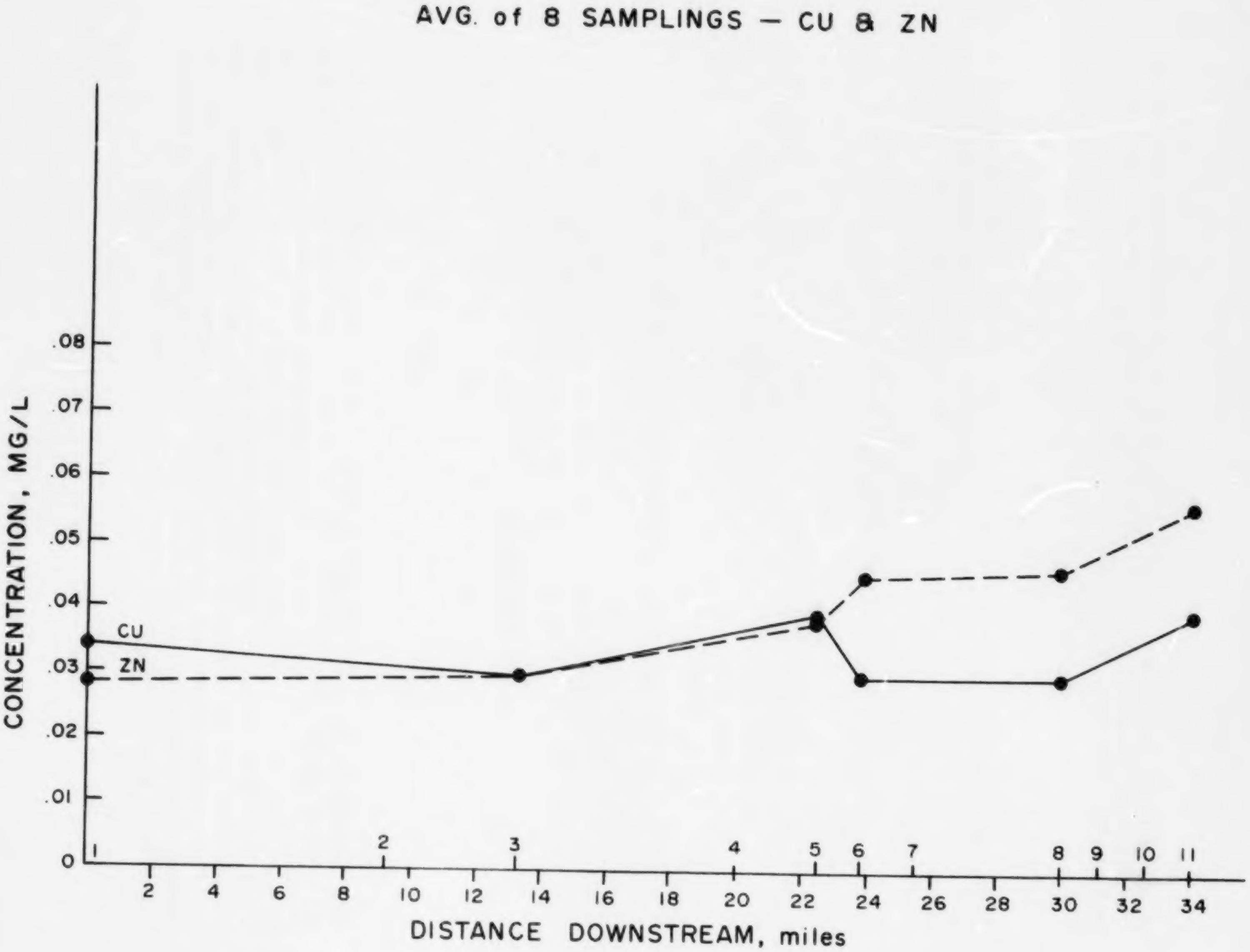


Figure 10 Cu and Zn vs. Distance Downstream During Study

The toxicity of copper to aquatic life is highly variable. Concentrations from 0.01 to 20 mg/l of copper sulfate ($CuSO_4$) have been used to control different aquatic fauna. Concentrations of copper in the form of $CuSO_4$ at a level of 0.14 mg/l is the highest concentration found to be tolerated by trout (7)

The sampling station which shows the highest average level of copper within the receiving stream is Station 11 at a level of 0.04 mg/l. This is largely due to the discharge of Eastman Kodak, the only point source discharge between Stations 10 and 11. The effect of the Eastman Kodak discharge is to raise the level of copper from 0.03 - 0.04 mg/l for a net increase of 33%.

The major problem with the copper concentrations within the Genesee River are sporadic high levels of Cu, up to 0.09 mg/l, which was measured on a sample taken at the same time as an observed fish kill.

ZINC

The average concentration of zinc measured at the six sampling stations over a period of eight samplings was found to be 0.041 mg/l. A plot of the average concentrations as a function of river mileage is shown in Figure 10. The complete data listing is contained within Appendix B.

The sources of zinc to the Genesee River within the study area are as follows:

Municipal Point Sources	lbs/day
GCO	9.88
Avon	0.78
Irondequoit	2.17/12.83

Municipal Non Point Sources (Combined Sewer Overflows)	lbs/day
Dry Weather:	15 mgd x 0.2 ppm = 24.9
Wet Weather:	115 mgd x 0.2 ppm = 191.0

Industrial Point Sources	lbs/day
Eastman Kodak	116.2
Lapp Insulator	.96
Worthington Turbines	.35/117.51

Therefore, under conditions of dry weather flow Eastman Kodak is responsible for 89% of the total zinc loading to the Genesee River within the Study Area. This compares to an average concentration of zinc measured at Station 11 of 0.057 mg/l and an average flow over the sampling period of 768 MGD yielding an average poundage of ∿ 361 lbs/day. If the loading prior to entry into the study area (0.03 mg/l at 214 MGD) is subtracted, a net average load of Zn to the study area is calculated to be approximately 307.9 lbs/day. The balance of the Zn measured within the Genesee River can be attributable to the flow from the Barge Canal. This is to a large degree supported by Zinc determinations measured within the Genesee River between Stations 5 and 6. On the average the River concentration increased from 0.038 to 0.046 mg/l while the average flow increased by approximately 240 MGD from 264.1 MGD to 504.1 MGD. This amounts to 35.3 pounds of zinc being discharged from the Barge Canal. According to the "Proposed Classifications and Standards Governing the Quality and Purity of Waters of New York State",(6) the level of zinc allowed in Class AA waters is 0.3 mg/l expressed as zinc. In the process of conducting the field sampling and analysis program the highest average concentration of zinc measured at any sampling station was the value of 0.058 mg/l measured at Station 11. In addition, no value of Zn measured in the receiving waters exceeded 0.125 mg/l.

McKee & Wolf (1963)(10) indicate that the sensitivity of fish to zinc varies with species, age and condition of the fish. While 0.3 mg/l of zinc has been reported to be toxic to mature fish, Schott(11) indicates that the lethal dosage to trout is 0.15 mg/l. From the point of view of improving the aquatic structure, or at a minimum maintaining it, point source discharges should be better controlled to keep the level of Zn below 0.05 mg/l.

TOTAL INORGANIC PHOSPHATE

The average concentration of total inorganic phosphate measured at the six sampling stations over a period of eight samplings was found to be 0.077 mg/l. A plot of the average concentrations as a function of river mileage is shown in Figure 11. The complete data listing is contained within Appendix B.

The sources of total inorganic phosphate (as P) to the Genesee within the area are as follows:

Municipal Point Sources	lbs/day	
GCO	387.9	(3.93 mg/l)
Avon	37.7	(4.83 mg/l)
Irondequoit	10.4/ 436.0	(6.38 mg/l)
Municipal Non Point Sources (Combined Sewer Overflows)	lbs/day	
Dry Weather:	15 mgd x 0.5 ppm - 477.2	
Wet Weather:	115 mgd x 4.0 ppm - 258.0	
Industrial Point Sources	lbs/day	
Eastman Kodak	1579.2	
Bausch & Lomb	646.5	
RG & E	66.9/2292.6	
Rural Non Point Sources (7)	lbs/day	
Cropland	214.0	
Pasture Land	25.5	
Forest Land	33.2/272.7	

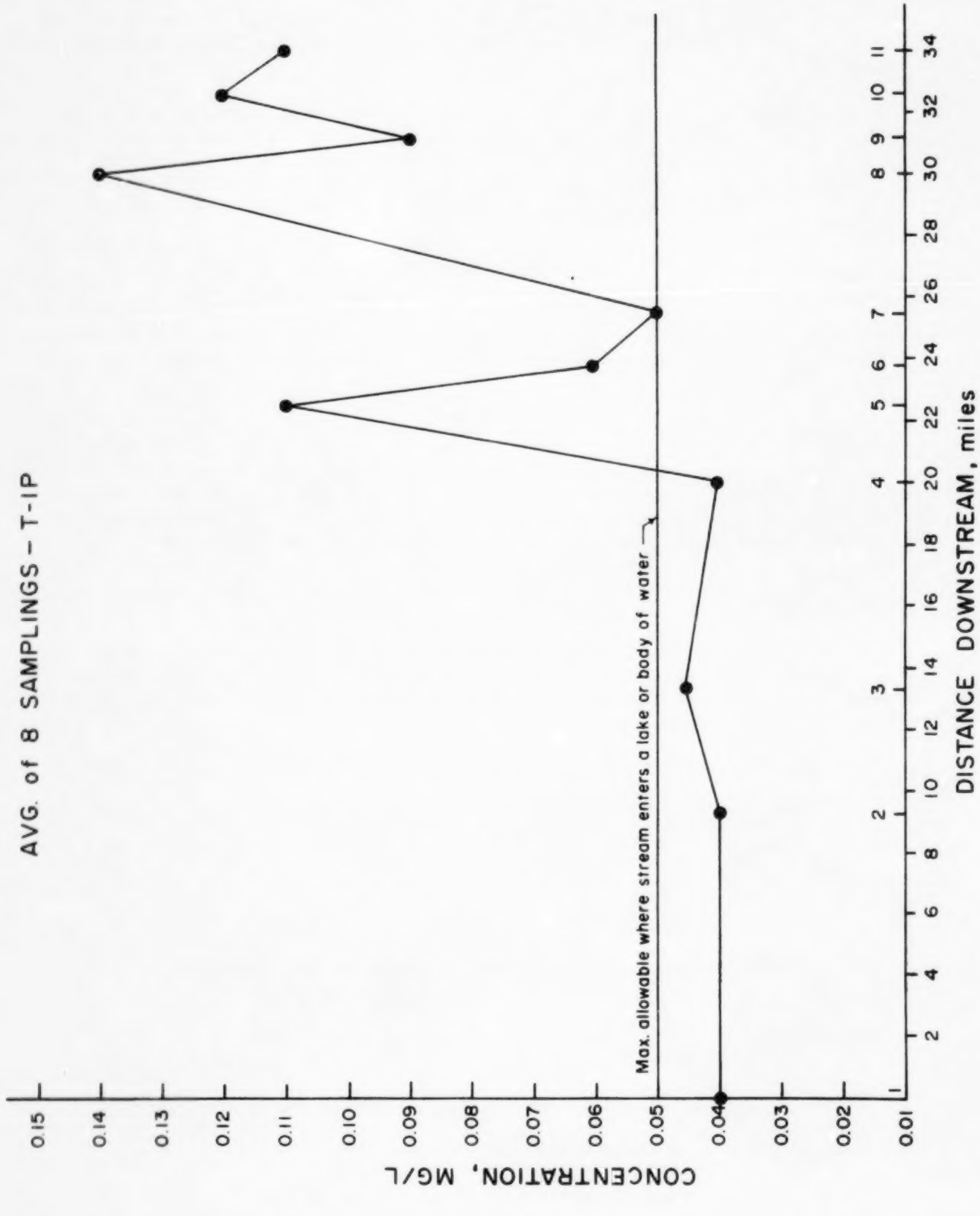


Figure 11 T-IP vs. Distance Downstream During Study

It is very interesting to note that within the study area, industrial point sources are the leading contributors of total inorganic phosphate. From the previously outlined daily loading estimates, it can be seen that of the ∿ 3000 average pounds of total inorganic phosphate discharged on a daily basis, industrial point sources represent approximately 76% of the total load. The largest single industrial discharger is Eastman Kodak, discharging an estimated 1579 pounds/day.

The least significant sources are the rural non-point sources such as pasture land, cropland and forest land resulting in a total of 272 pounds/day of total inorganic phosphate. It is surprising that the municipal point and non-point sources are as low as they are. In a nationwide estimate, municipal point sources are responsible for 44-56% and runoff from cultivated and feedlot land ranging from 41-54%(9) of man's average annual contribution of phosphorus to our nation's waters.

The average concentration of total inorganic phosphate measured at the 11 stations was 77 ug/l which is considerably greater than the level of 50 ug/l suggested by EPA and NYSDEC for any stream at the point where it enters any reservoir or lake. It should be noted that the average concentration of total inorganic phosphorus measured at sampling Station 11 was 110 ug/l, a value considerably higher than the average total stream measured concentration of 77 ug/l.

Under average conditions the flow at the last sampling station was measured to be 768 MGD. Utilizing the average concentration of total inorganic phosphorus measured at Station 11 a total loading to Lake Ontario of 408.0 lb/day was calculated. This compares with the value of approximately 3258 lb/day as measured or calculated from inputs within the study area and a background level of 458 lb/day prior to the study area. This shows considerable uptake by aquatic life and suspended matter via ion exchange and/or adsorption.

CHROMIUM

The average concentration of chromium measured at the six chemical sampling stations over a period of eight samplings was found to be 0.019 mg/l. A plot of the average concentrations as a function of river mileage is shown in Figure 12. The complete data listing is contained within Appendix B.

The sources of copper to the Genesee River within the study area are as follows:

Municipal Point Sources	lbs/day
GCO	12.85
Avon	0.78
Irondequoit	1.03/14.66

Municipal Non Point Sources (Combined Sewer Overflows)	lbs/day
Dry Weather:	15 mgd x 0.02 ppm = 19.1
Wet Weather:	115 mgd x 0.02 ppm = 2.5

Industrial Point Sources	lbs/day
Eastman Kodak	20.92
RG & E Bee Bee	9.24
Lapp Insulator	.05/30.21

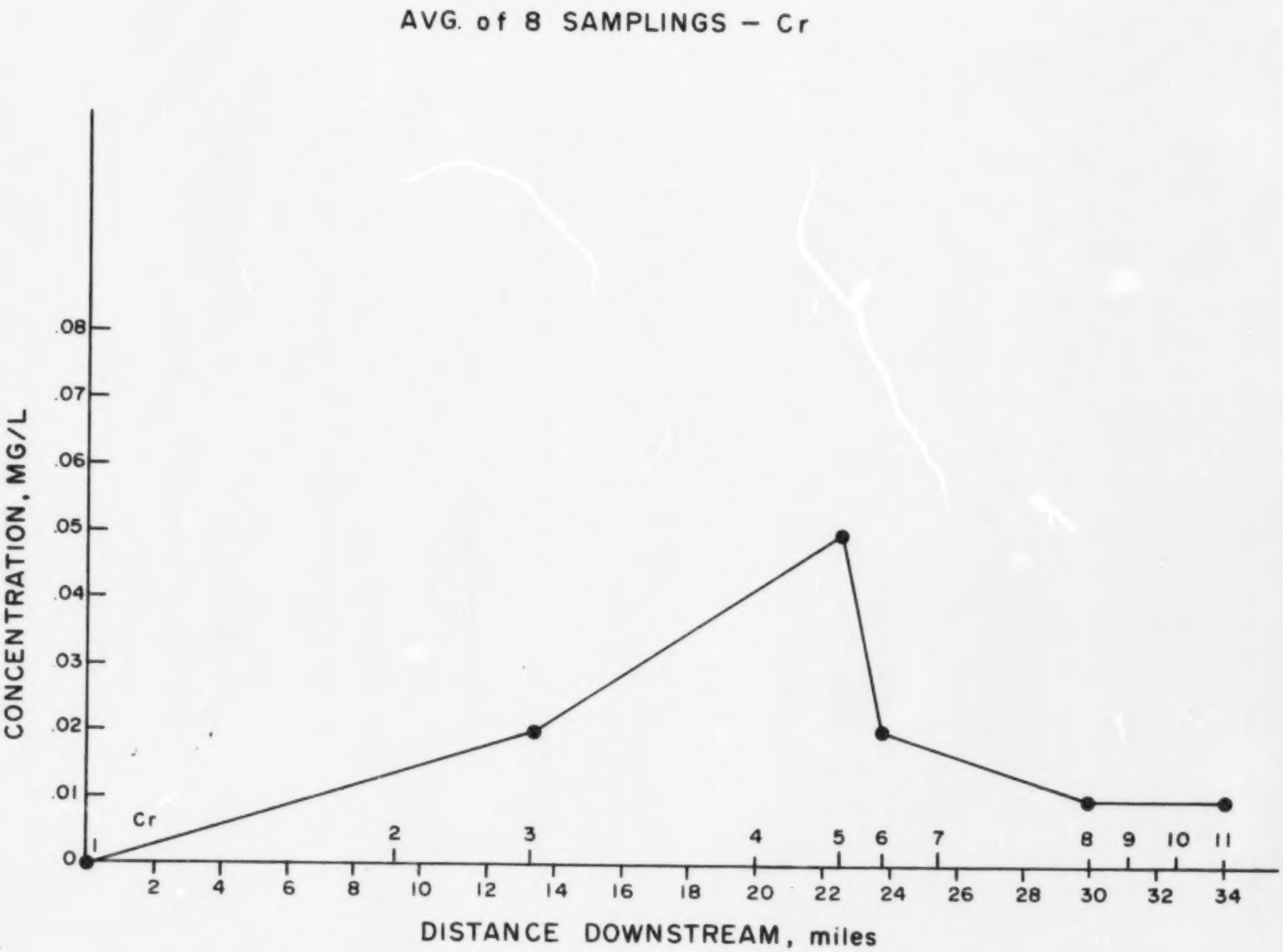


Figure 12 Cr vs. Distance Downstream During Study

These loadings compare to the average concentration of Cr measured at stations 8 and 11 of 0.01 mg/l. On the basis of an average flow of 768 MGD a total of 61.44 pounds/day of Cr was calculated for the Genesee River. Approximately one half of this measured quantity can be attributed to areas outside of the study area and the Barge Canal.

The sampling station which shows the highest average concentration of chromium is Station 5, at a level of 0.05 mg/l. This level of Cr reflects the influence of the GCO municipal treatment plant discharge. The 12.85 lbs/day average contribution from the GCO plant is equal to the quantity of Cr measured in the Genesee River prior to the point of intrusion of the GCO discharge.

The reported level of chromium expected to be toxic toward aquatic life is dependent upon the species, temperature, pH, valence of the chromium component and any synergistic or antagonistic effects caused by the presence of other chemical constituents. A concentration of 5 mg/l of hexavalent chromium has been reported to be toxic toward fish(12). The effect of chromium toward plankton, protozoa, bacteria and other lower forms of aquatic life are more critical.

In general, the level of chromium measured within the Genesee River is not critical under average flow conditions. However, the impact of the GCO discharge on the stretch of river between mile points 22.5 and 23.75 could become critical under critical low flow conditions. It is possible that Cr concentrations could reach levels approaching 0.185 mg/l assuming an average/critical flow volume ratio of 3.7 in this stretch.

MERCURY

The average concentration of mercury measured at the six sampling stations over a period of eight samplings was found to be 3.5 ug/l. A plot of the average concentrations as a function of river mileage is shown in Figure 13. The complete data listing is contained within Appendix B.

The sources of mercury to the Genesee River within the study area are as follows:

Municipal Point Sources	lbs/day
GCO	0.166
Avon	0.001
Irondequoit	0.017

Municipal Non Point Sources (Combined Sewer Overflows)	lbs/day
Dry Weather:	15 mgd x 0.001 ppm = 0.12
Wet Weather:	115 mgd x 0.001 ppm = 0.06

Industrial Point Sources	lbs/day
Eastman Kodak	0.22
Worthington Turbine	0.42

The maximum average concentration of mercury measured in the Genesee River during the sampling program was 4.5 ug/l which was determined at Station 3. There is, however, no

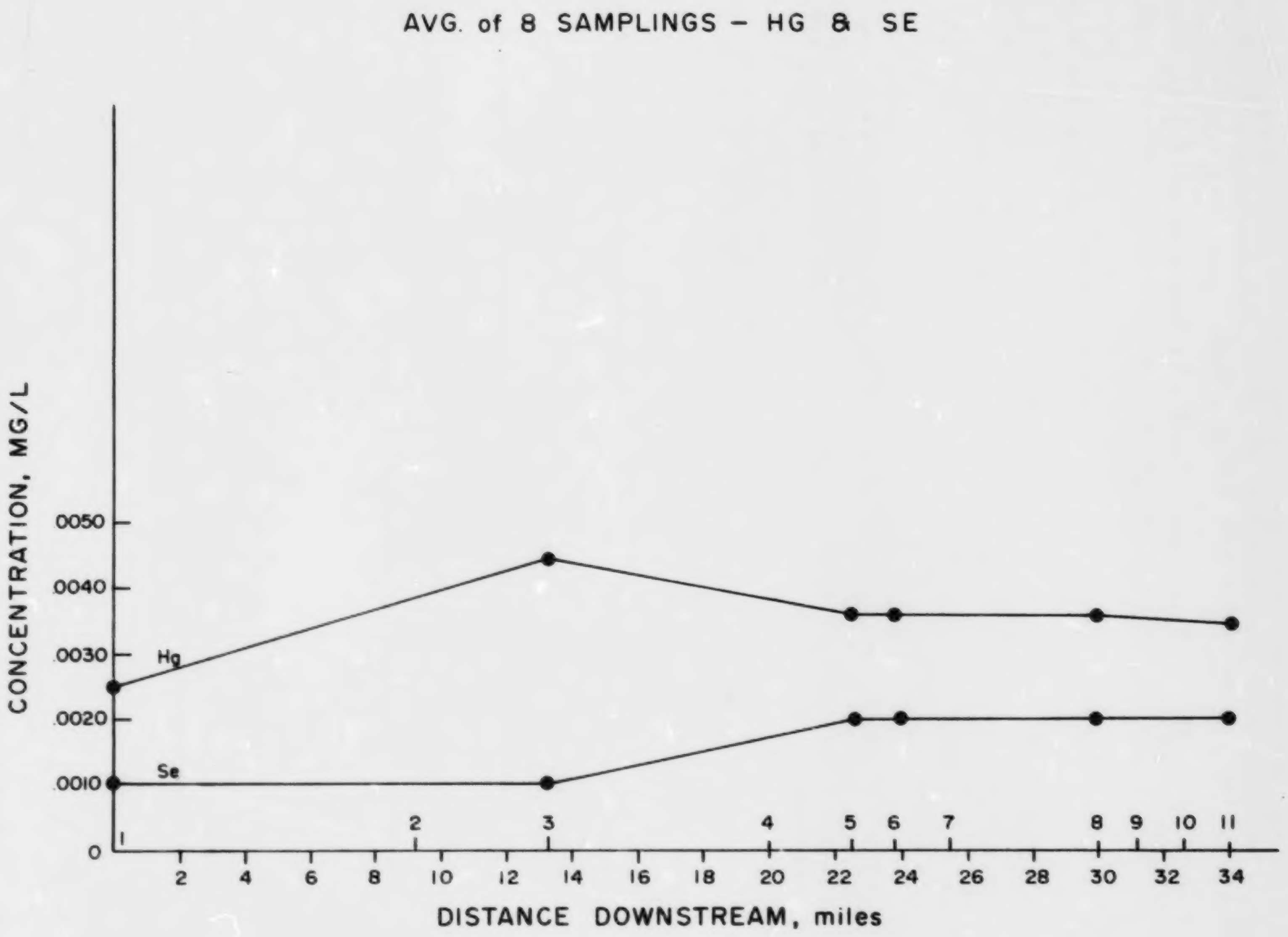


Figure 13 Hg and Se vs. Distance Downstream During Study

significant increase in the level of mercury measured within the receiving stream due to the above mentioned sources except for that slight increase at Station 3 which is likely due to the influence of the discharge from Worthington Turbine.

Presently, the levels of mercury measured within the Genesee River are not at unnaturally high levels. It is not uncommon to find levels of mercury at a level of several micrograms in a receiving stream, particularly one traversing an urban area.

The measured levels of mercury are well below reported toxic thresholds to humans, fish or other forms of aquatic life. The lowest level of mercury as the mercuric ion for fresh water fish found to be toxic is 4 ug/l as reported by Doudorff.(13) This does not mean to imply that recently involved biological metabolic methods of concentration of organic mercury fractions may not lead to an accumulation of mercury in certain forms of aquatic life.

SELENIUM

The average concentration of selenium measured at the six sampling stations over a period of eight samplings was found to be 1.6 ug/l. A plot of the average concentrations as a function of river mileage is shown in Figure 13. The complete data listing is contained within Appendix B.

The only measured source of selenium to the Genesee River is the discharge of Eastman Kodak which has been shown to account for a loading of approximately 1.39 lbs/day. To date the sanitary and combined sewer overflow discharges to the main stem of the Genesee River within the study area have not been assessed.

The average concentration of Se measured in the Genesee River falls into two categories, 1 ug/l and 2 ug/l. There appears to be no major influence except for the GCO STP. The influence of the GCO STP is indicated by the presence of a 1 ug/l increase in average selenium concentration observed between Stations 3 and 4. The maximum concentration of selenium measured during the sampling program was 4 ug/l. This would indicate that there is neither significant concentration variation nor the approaching of any critical concentration threshold.

The levels of Se measured within the Genesee River are well below the USPHS Drinking Water Standard(14) of 10 ug/l and as such appear to present no significant problem. Additionally, the median threshold effect for a 48-hour exposure for Daphnia was determined to be 2.5 ug/l.(16)

IRON

The average concentration of iron measured at the six sampling stations over a period of eight samplings was found to be 0.46 mg/l. A plot of the average concentrations as a function of river mileage is shown in Figure 14. The complete data listing is contained within Appendix B.

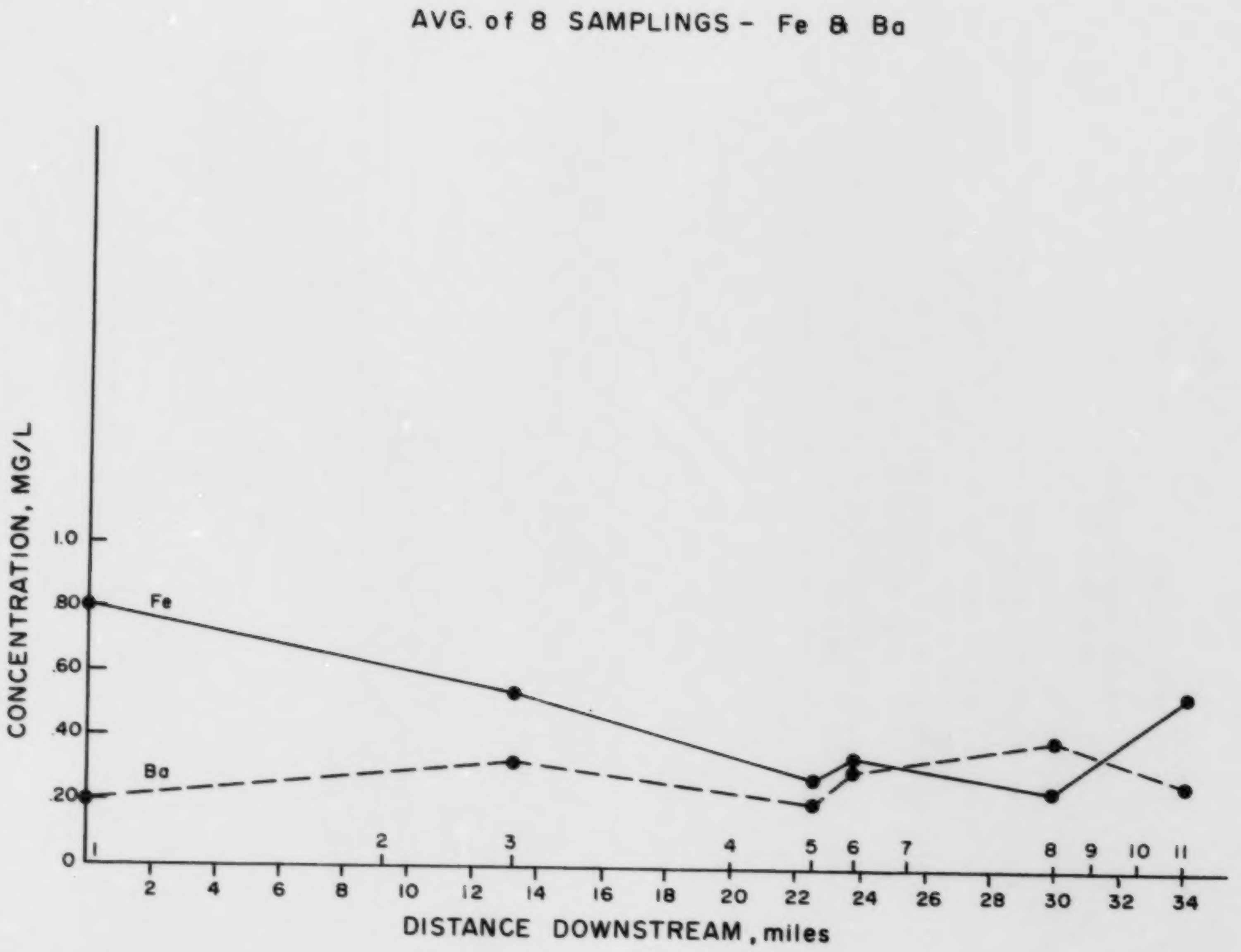


Figure 14 Fe and Ba vs. Distance Downstream During Study

The industrial sources of iron to the Genesee River within the study area are as follows:

	lbs/day
Eastman Kodak	302.4
Rochester Gas and Electric (BeeBee Station)	463.6

The average river concentration of iron starts at 0.8 mg/l at Station 1 and declines steadily to a value of 0.28 mg/l at Station 5. Between Stations 5 and 6, there is a slight increase in the river concentration which is likely due to the influence of the Barge Canal. The measured average concentration of iron then declines between Stations 6 and 8, only to be influenced by the Eastman Kodak discharge and consequently discharges to Lake Ontario with an average concentration of approximately 0.54 mg/l.

According to Southgate(16), the toxicity of iron and derived iron salts largely depends upon whether the iron is present in the ferrous or ferric state and whether it is in solution or suspension. It appears as though in most waters, the iron is oxidized to its +3 oxidation state and subsequently the colloidal hydrated oxide precipitate. The deposition of these particulate forms on the gills of fish may cause an irritation and blocking of the respiratory transport system. At lower pH's (below 5.5), the iron will remain in a soluble form and present a more toxic environment to the aquatic life. Under these depressed pH conditions pike, tench, trout, and carp have been found not to be able to survive at concentrations less than 1 mg/l.

In general, however, the average river concentration of 0.46 mg/l of Fe should not create any major problems with regard to creating a toxic environment within the study area of the Genesee River. The wide ranging variation in the iron concentration occurring at Station 11 of 0.15-1.12 mg/l could create some possible problems for very sensitive species i.e. rainbow trout, etc.

BARIUM

The average concentration of barium measured at the six sampling stations over a period of eight samplings was found to be 0.27 mg/l. A plot of the average concentration as a function of river mileage is shown in Figure 14. The complete data listing is contained within Appendix B.

The sources of barium to the Genesee River within the study area are as follows:

Municipal Point Sources	lbs/day
GCO	0.988
Avon	0.078
Irondequoit	0.104

Municipal Non Point Sources (Combined Sewer Overflows)	lbs/day
Dry Weather:	15 mgd x 0.01 = 1.2
Wet Weather:	115 mgd x 0.01 = 9.5

Industrial Point Sources	lbs/day
Eastman Kodak	1778

The receiving stream has a fairly uniform concentration of Ba as a function of river mileage. The concentration within the receiving stream is highest within the city limit and upstream of Eastman Kodak. The receiving stream does not reflect the concentrations of Ba that should be observed in light of the Eastman Kodak discharge permit reported value. Sulfate, carbonate or other barium sinks can be quite significant. Barium readily forms insoluble barytes, $BaSO_4$ and witherite ∿ $BaCO_3$ minerals.

Soluble barium salts in the form of the chloride, acetate, fluoride and nitrates generally exhibit no significant toxic effects on aquatic life. Lethal dosages for any of the barium salts are well above 25 mg/l. The most toxic form is as the chloride with recorded toxic thresholds of 29 mg/l for Daphnia magna in Lake Erie water(17) and 50 mg/l for young silver salmon(18).

Additionally, the USPHS in the 1962 Drinking Water Standards established a limit on the concentration of Ba in drinking water of 1.0 mg/l. This limit was presumably established on the basis of possible toxic effects of barium on the heart, blood vessels, and nerves(13). The fatal oral dose of barium for man has been reported to be 550 to 600 mg.

TOTAL SUSPENDED SOLIDS

The average concentration of total suspended solids measured at the six sampling stations over a period of eight samplings was found to be 39 mg/l. A plot of the average total suspended solids concentration as a function of river mileage is shown in Figure 15. The complete data listing is contained within Appendix B.

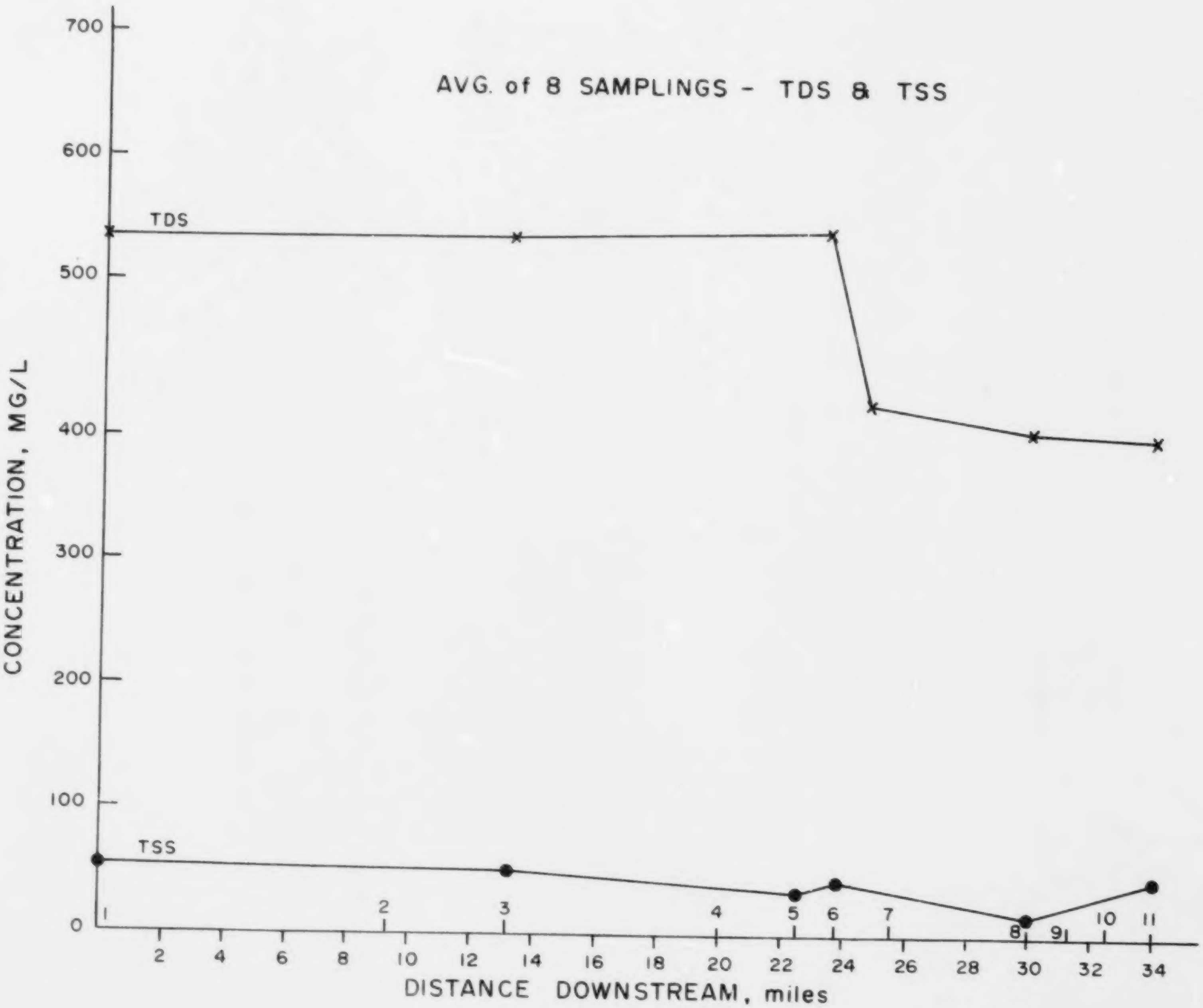


Figure 15 TDS and TSS vs. Distance Downstream During Study

The sources of total suspended solids to the Genesee River within the study area are as follows:

Municipal Point Sources	lbs/day
GCO	6136
Avon	347
Irondequoit	312/6795 lbs/day

Municipal Non Point Sources (Combined Sewer Overflows)	lbs/day
Dry Weather:	15 mgd x 100 ppm = 12,500
Wet Weather:	115 mgd x 350 ppm = 335,417

Industrial Point Sources	lbs/day
Eastman Kodak	9296
Bausch and Lomb	2490
Rochester Gas and Electric - BeeBee Station	129,090
Pennwalt Corp.	422
Worthington Turbine	150/141,448

The average measured river concentration of total suspended solids starts at 55 mg/l at Station 1 and decreases fairly uniformly to a value of approximately 20 mg/l measured at Station 8. Slight increases in suspended solids concentrations can be seen above the general decreasing trend at Stations 6 and 11. The increases in suspended solids at these points likely reflect the influence of the GCO and Eastman Kodak discharges. These two sources together with that from Bausch and Lomb represent the three significant point sources of suspended material discharged to the Genesee River within the study area. It should be noted that the solids represented by the Rochester Gas and Electric-BeeBee Station discharge is largely the ambient level of Genesee River Suspended Solids measured within the intake water.

Only a small fraction of the 160,743 pounds/day of suspended solids measured within the Genesee River can be accounted for by point source discharges. At least 77% of the suspended solids are of an inert variety which can only be attributed to errosion contribution of clays and other natural silicate based materials.

The presence of suspended solids may create a toxic effect on aquatic life by causing excessive abrasion of the organism, clogging of the gills and respiratory passages and the destruction of spawning grounds and resulting eggs and young by blanketing the stream bottom.

TOTAL DISSOLVED SOLIDS

The average concentration of total dissolved solids measured at the six sampling stations over a period of eight samplings was found to be 475 mg/l. A plot of the average total dissolved solids concentration as a function of river mileage is shown in Figure 15. The complete data listing is contained within Appendix B.

SECTION VI

AQUATIC STRUCTURE OF THE GENESEE RIVER

PROCEDURES

Eight surveys of the Genesee River were conducted by personnel from the Lake Ontario Environmental Laboratory (LOTEL) of the State University of New York, College at Oswego between July 18 and October 18, 1973. Eleven stations consistent with the chemical stations were located between Avon, New York, and the Rochester harbor mouth (see Figure 1). During each survey, plankton and benthos samples were taken at six stations (No. 1, 5, 6, 8, and 11). Water quality variables, such as dissolved oxygen, pH, nutrients and BOD were determined at all of the sampling stations. Physical measurements such as currents and temperature were also taken.

Surface and bottom water samples were taken at each station using an 8.1 liter non-metallic VanDorn bottle. Five liters from each depth were strained through a 20-mesh plankton net, and each combined into one composite sample. A total of three replicate composite samples were taken at each station. The zooplankton component of each sample was narcotized using carbonated water, then the sample was preserved with a Lugol's-ethanol solution. Both phytoplankton and zooplankton were enumerated by counting 30 random fields of a Sedwick-Rafter cell under 200X. Identification to genus or species was accomplished using a 1000X inverted, phase contrast microscope after Utermohl(19). Phytoplankton were identified according to Prescott(20), Palmer(21) and Tiffany and Britton.(22).

Triplicate samples for benthic organisms were obtained each month using a 6 x 6 inch Eckman grab sampler. These samples were washed in the field using a US 30 mesh screen, and the organisms preserved in 70% ethanol.

In the laboratory, organisms were removed from the debris, with a combination of hand sorting, and the sucrose floatation technique of Anderson.(23) Chironomidae and Oligochaeta were mounted in permanent preparations of Turtox. CMC 10 with a small amount of acid fuchsin stain. Larger organisms were examined in 70% ETOH under high resolution dissecting microscopes.

All organisms were identified to species where possible. Chironomidae were identified with the Keys of Beck and Beck(24); Chernovski(25); Johannsen(26,27,28); Mason(20); Roback(30); and Thienemann(31). Oligochaeta were identified according to Brinkhurst, Hamilton and Herrington(32); Brinkhurst(33); Brinkhurst and Jamieson(34); Hiltunen(35); and Sperbe(36). Other invertebrates were keyed with Pennak(37) and Usinger(38). Footnotes to the tables of invertebrates give specific information concerning other identifications.

Fish were sampled once on October 18-19, 1973, with a 10 foot trawl. Tows were made close to the bottom of the river for 10 minutes. Determinations made were species, standard length, weight, sex, sexual maturity and stomach contents. Samples were stored at -20°C for analysis in the laboratory.

STATISTICAL METHODS OF ANALYSIS

The diversity index, alpha, of Fisher, Corbet and Williams(39) was calculated for each plankton and benthos sample. This particular index was used in preference to others Wilhm(40); because the theoretical distribution underlying this index seems to more closely approximate the actual distribution of organisms in natural population, and the distribution seems to have more basis in ecological principles(41).

For any sample or organisms from naturally occurring populations, N (the total number of individuals), S (the total number of species) and α (alpha, the diversity) are related as follows in equation(1).

$$S = \quad \log_e \left(1 + \frac{N}{\alpha}\right) \qquad (1)$$

Therefore, given N and S for sample, α can be determined. The solution for α is however, according to Fisher, "difficult and indirect". Table 1 in Appendix C was therefore constructed from the relationship in Equation 2.

$$\frac{N}{S} = \frac{\left(e^{\frac{S}{\alpha}} - 1\right)}{S/\alpha} \qquad (2)$$

Given the $\log_{10}$ N/S, $\log_{10}$ N/α can be obtained from Table 1. From $\log_{10}$ N/α, the value of α can be calculated. An alternative method of determining α is shown in Figure 16.

In general, the diversity index α indicates whether a biological community is stressed or unstressed. A stressed community would be represented by a few species of organisms in relation to the total number. An unstressed community would have a relatively large number of species in relation to the total number of organisms.

RESULTS AND DISCUSSION

PLANKTON - GENERAL

Plankton variety and quality are controlled by many factors, including water temperature, carbon dioxide and dissolved oxygen concentration, intensity and duration of light and concentration of nutrients. These factors are interrelated as well. Blooms of phytoplankton occur when all the conditions listed above are in optimum proportion for maximum growth. Blooms or pulses can produce cell concentrations so dense that photosynthesis is reduced to the point that the cell cannot maintain itself and dies. A massive die-off of phytoplankton then results in anaerobic conditions making the aquatic environment unfit for the survival of other types of organisms.

A river or lake may be categorized as oligotrophic, mesotrophic or eutrophic based on nutrient concentrations, growth of certain types of organisms and other factors. Oligotrophic waters are characterized by low nutrient concentrations and phytoplankton populations in which diatoms predominate while eutrophic waters have high nutrient concentrations and a relatively high proportion of blue-green algae(42). In the latter case, numbers of diatoms would be relatively low.

As in benthic communities, discussed later in this report, phytoplankton communities found in oligotrophic waters usually have low numbers with a relatively large number of species represented. Conversely, eutrophic or otherwise stressed waters may have large numbers of phytoplankters with a relatively small number of species. This represents a phytoplankton community in which diversity of species is low. The diversity index, alpha, is a measure of quality of the environment in which the organisms live. When this information is coupled with species distribution and life history of the population, a body of water can be characterized more completely.

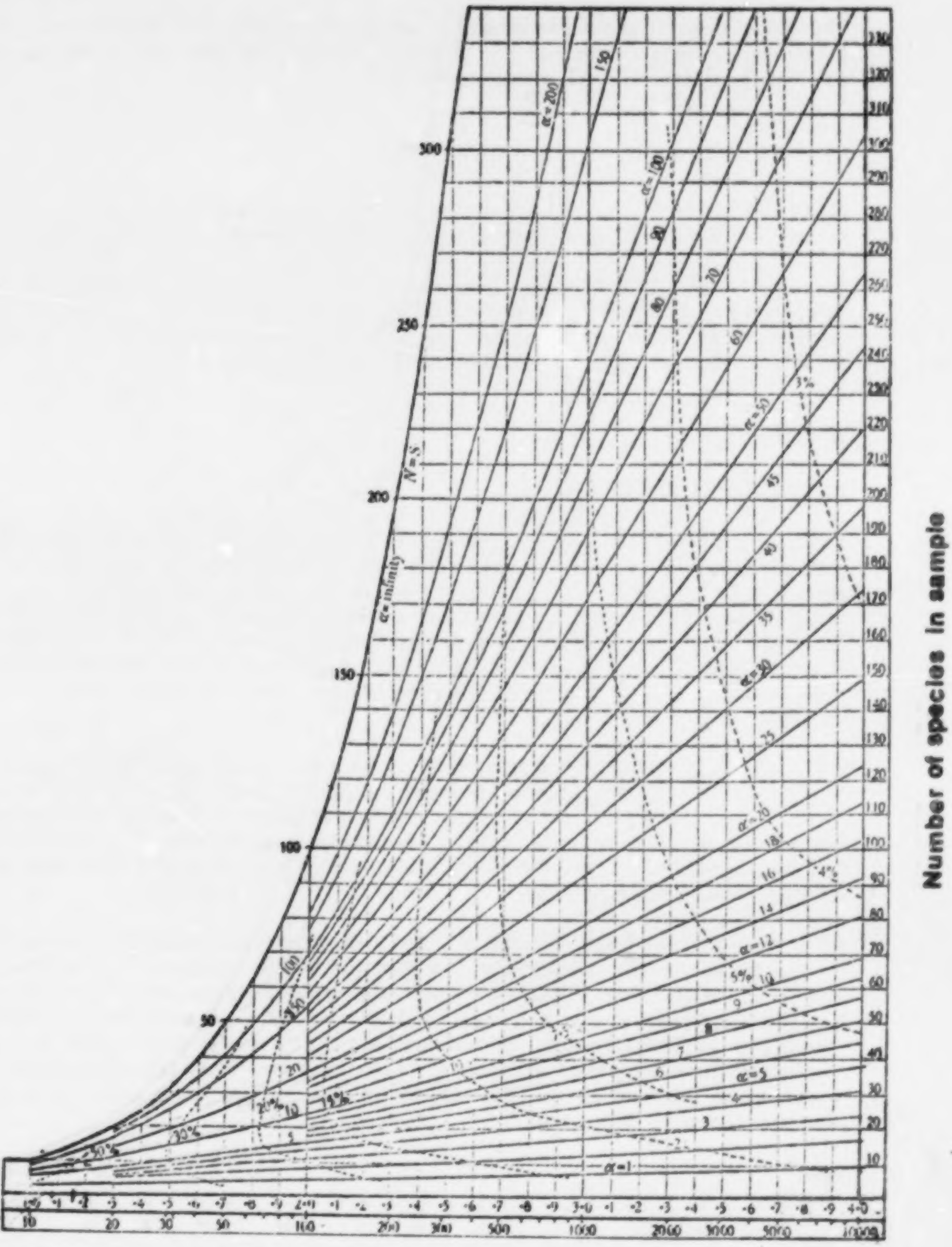


Figure 16 Relation between numbers of species and individuals in samples

A trend for succession of phytoplankton is generally related to the season of the year. Blue-green alage such as Oscillatoria, Anabaena, Gleocystis and Microcystis are favored by higher summer temperatures (25-30°C), while diatoms such as Navicula, Fragilaria, Melosira, Gyrosigma and Cyclotella prefer cooler temperatures. The growth of blue-green algae is also favored by pH 7.2 or above.

These phytoplankton may serve directly as a source of food for plankivorous fish and fish larvae, or they may be grazed by zooplankton such as Cyclops and Diaptomus(43). Cladocerans found in open lakes or rivers include the genera Daphnia, Bosmina, Diaphanosoma, Chydrous, and Ceriodaphnia(37). These organisms may be the dominant genera in the spring(44). Bosmina longirostrus is a common species found in flowing streams and rivers, however, according to Schindler(45), it seldom becomes a dominant form. Cladocerans tolerate a wide range of calcium concentrations, pH and dissolved oxygen.

Rotifers feed on detritus and bacteria and contribute to the zooplankton population Common genera found in running water are Keritella, Synchaeta, Polyarthra, Asplanachna, Braschionus, Kellicotta, Trichocera, Notholco and Euchlanis(43).

Total cell number, species distribution and diversity indices were determined for phytoplankton and zooplankton samples from six stations in the Genesee River. Station locations are illustrated in Figure 1.

PLANKTON - RESULTS

In general, diatoms and green algae were the dominant forms of phytoplankton at all stations sampled during the year. Figures 17-20 show the total number of plankton organisms and the distribution by class for August 1-2, September 12-13, September 26 and October 19, 1973, respectively. Other collections were incomplete and could not be plotted graphically. Results by individual species are shown in Tables 2-16 of Appendix C. The zooplankton component was significant only in the August 1-2, 1973, samples at Stations 1, 3 and 5, although on these dates zooplankton never contributed more than about 15% of the total population.

The trend is towards a decrease in diversity indices of plankton populations from Station 1 to Station 11. Total number of plankton, diversity index and composition of the population usually change rather significantly between Stations 5 and 6. At a point between these Stations the Barge Canal intersects the Genesee River and apparently contributed nutrients, a different plankton population or growth inhibitors of stimulants which affect a selected portion of the plankton population. As seen in Figure 21 through 24, total numbers of plankton either remain relatively constant or increase for all sampling dates from Station 1 to Station 11.

Blue-green algae were a significant part of the phytoplankton at Stations 1 through 5 on September 12-13, 1973. The genus Oscillatoria was the most abundant blue-green algae followed by Anabaena and Anacystis. The growth of blue-greens are generally favored by warmer water temperatures and eutrophic conditions. The diversity indices decrease for samples taken on these dates in the lower river due to the reduction of the blue-greens and increase in numbers of green algae.

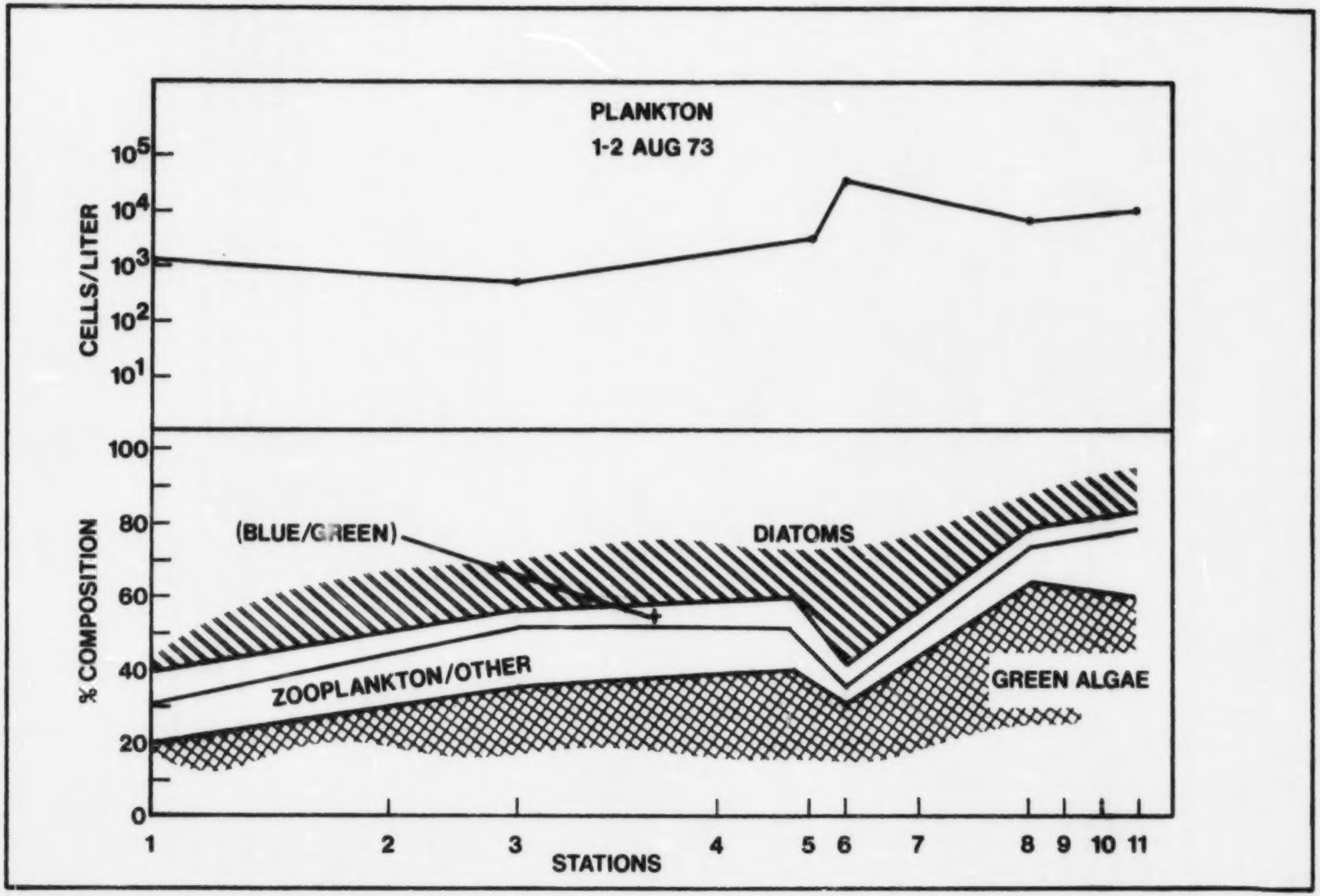


Figure 17 Plankton 1-2 August 73

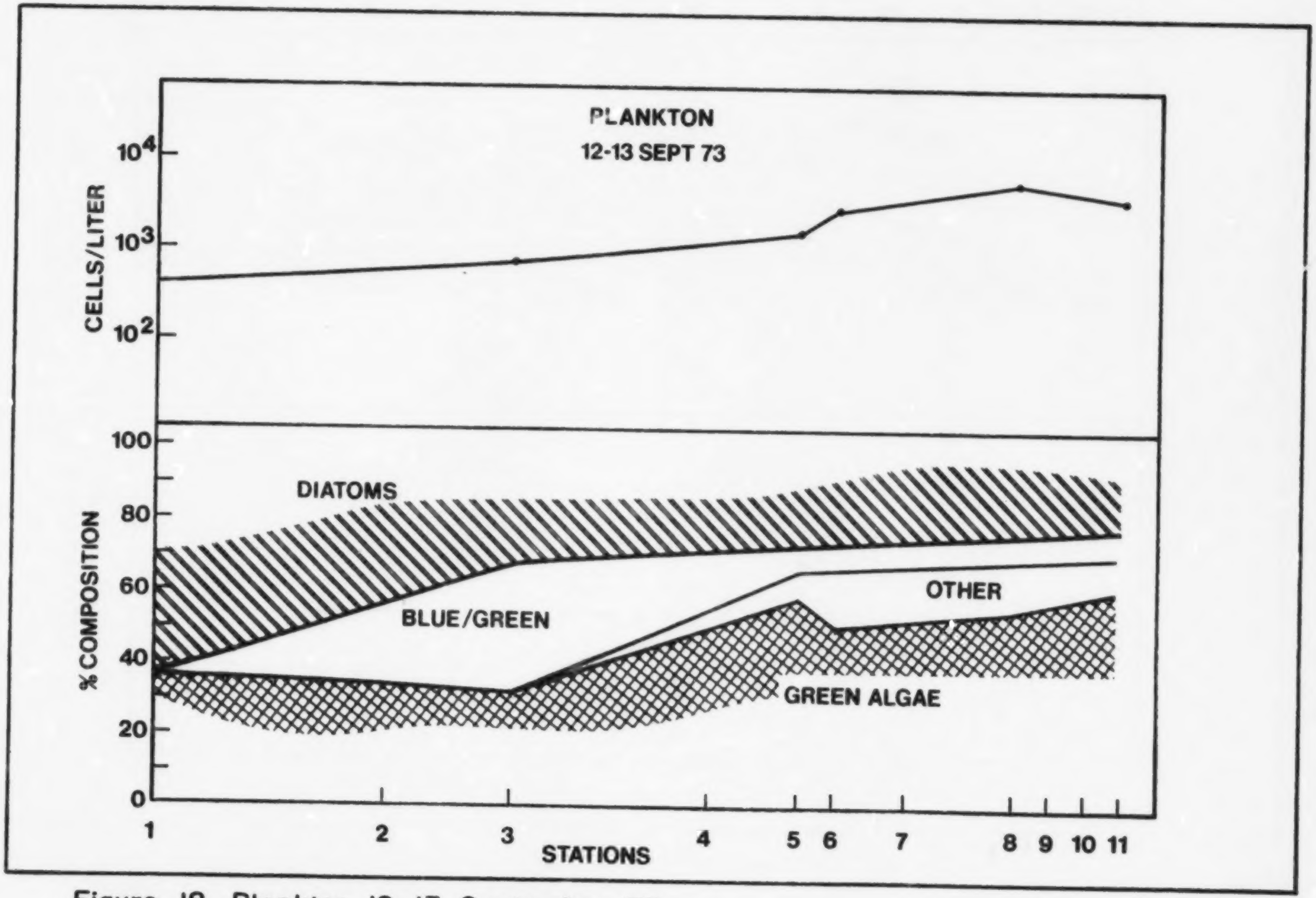


Figure 18 Plankton 12-13 September 73

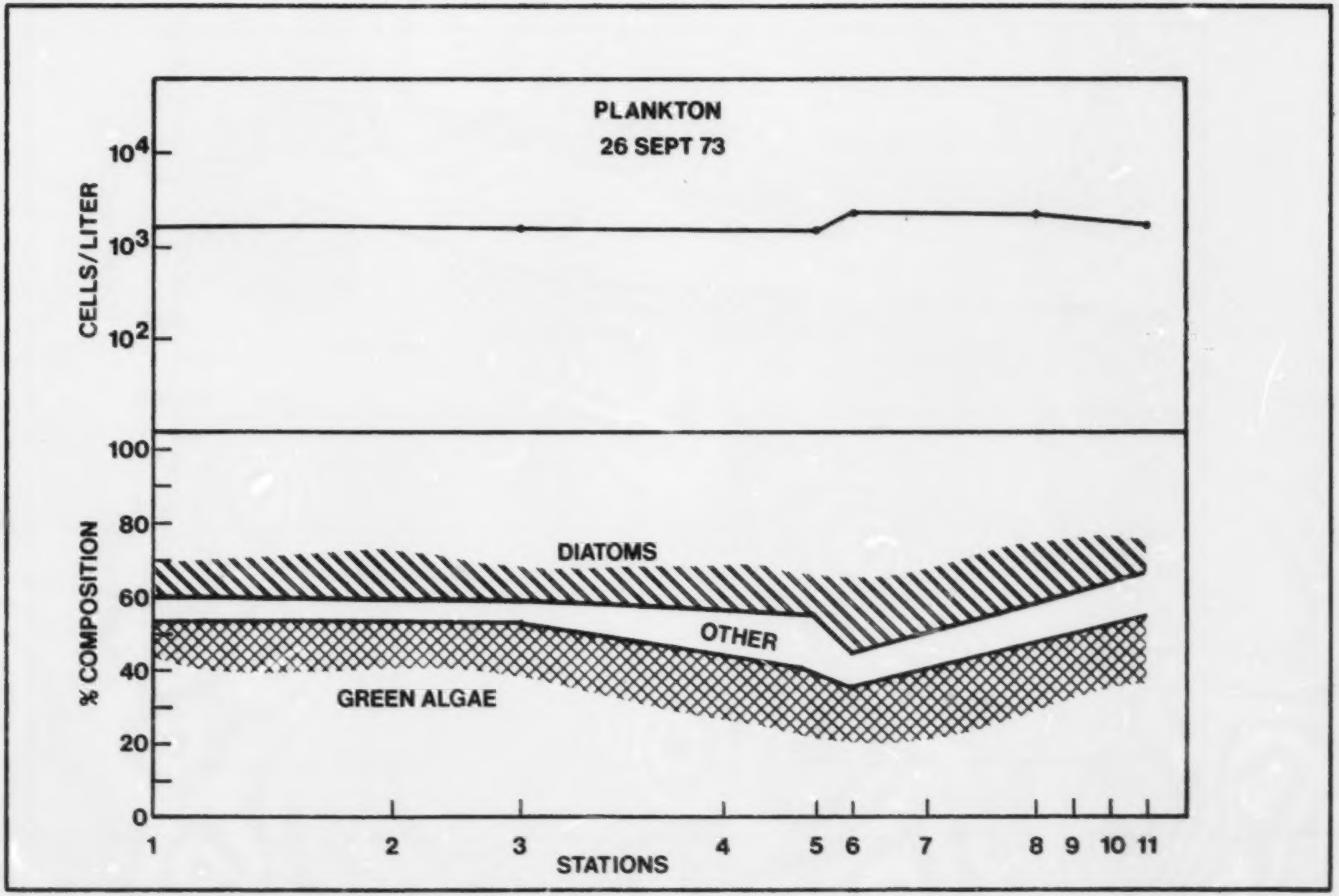


Figure 19 26 September 73

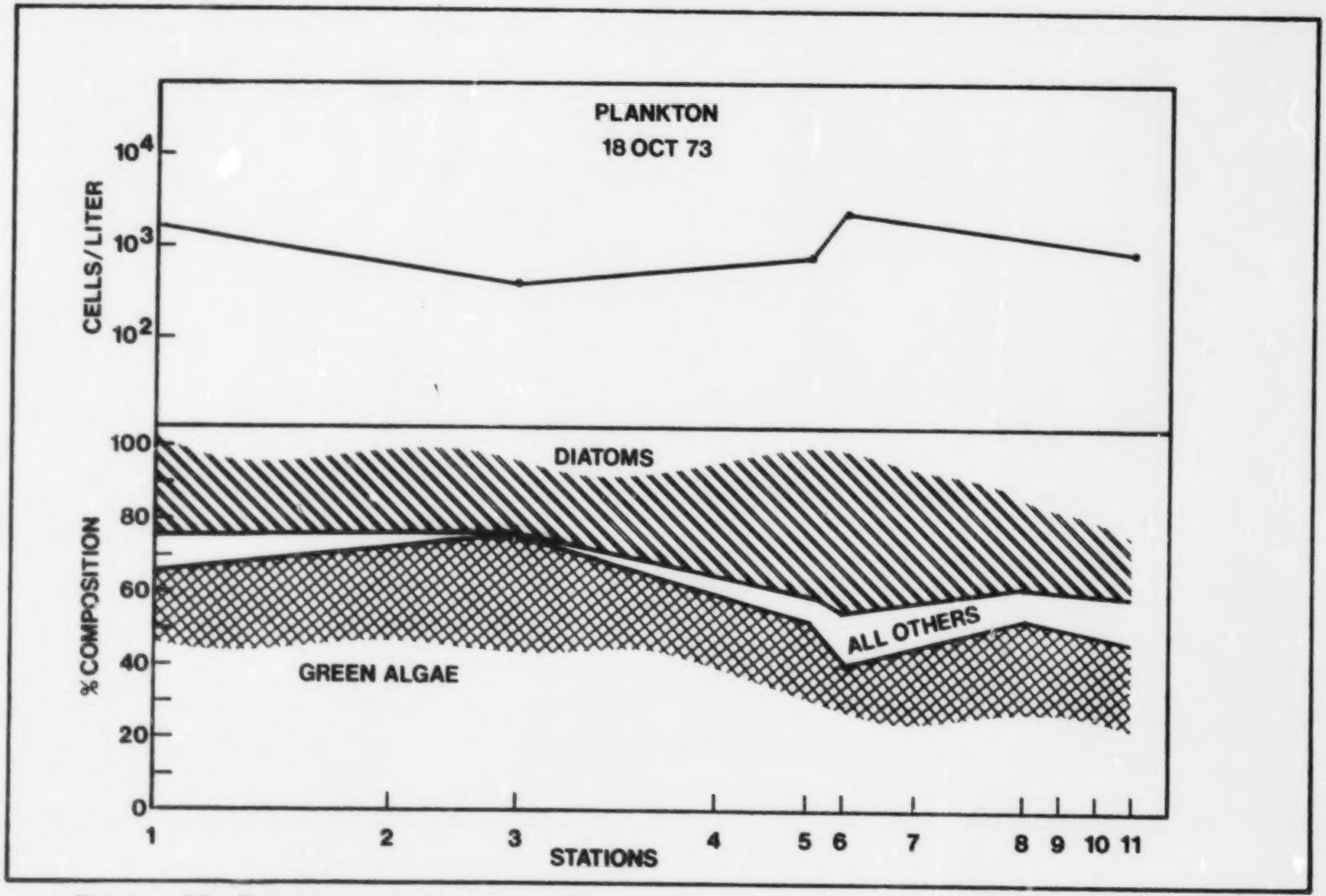


Figure 20 Plankton 18 October 73

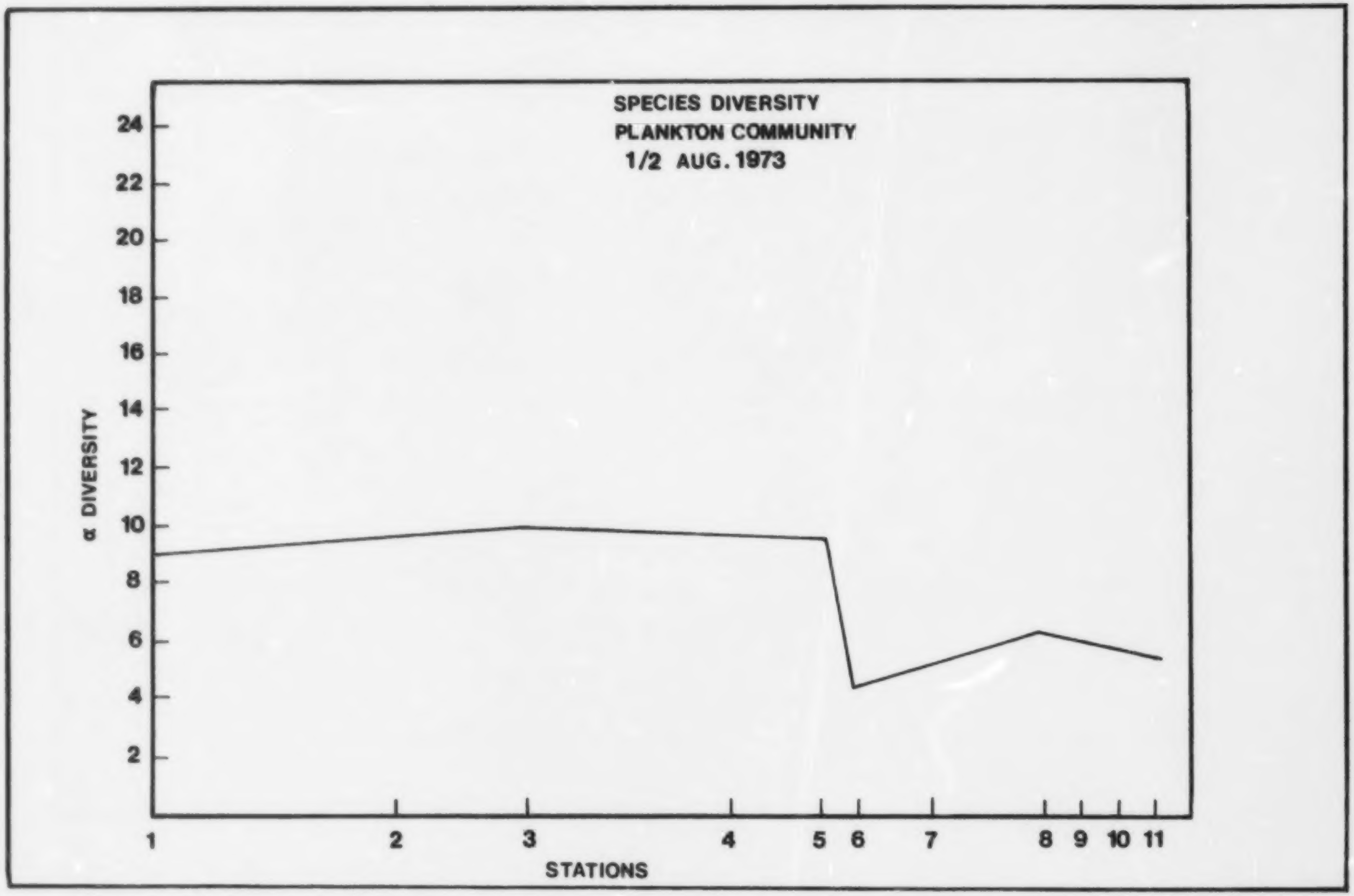
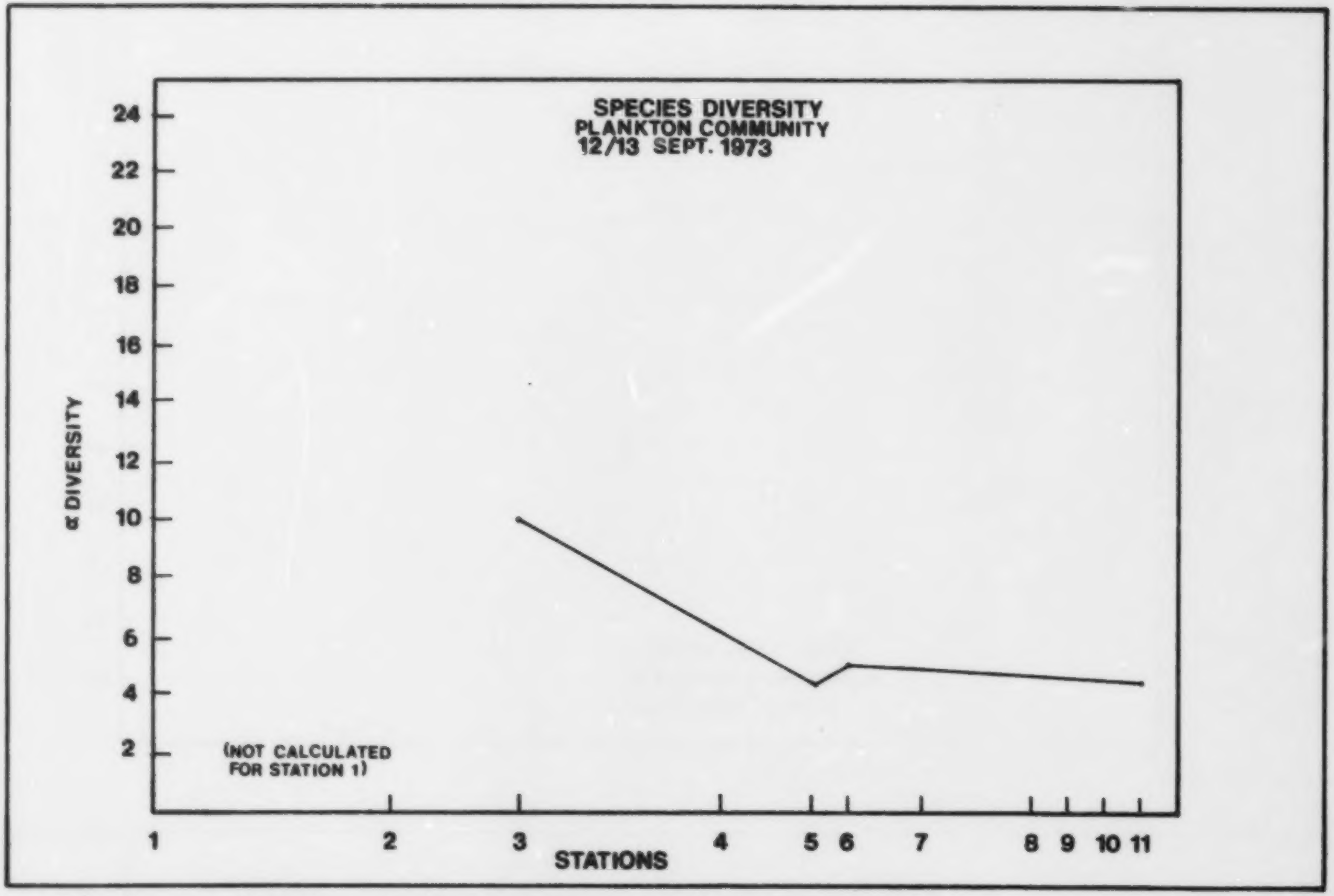


Figure 21 Species diversity - plankton community 1-2 August 73



22 Sepcies diversity - plankton community 12-13 September 73

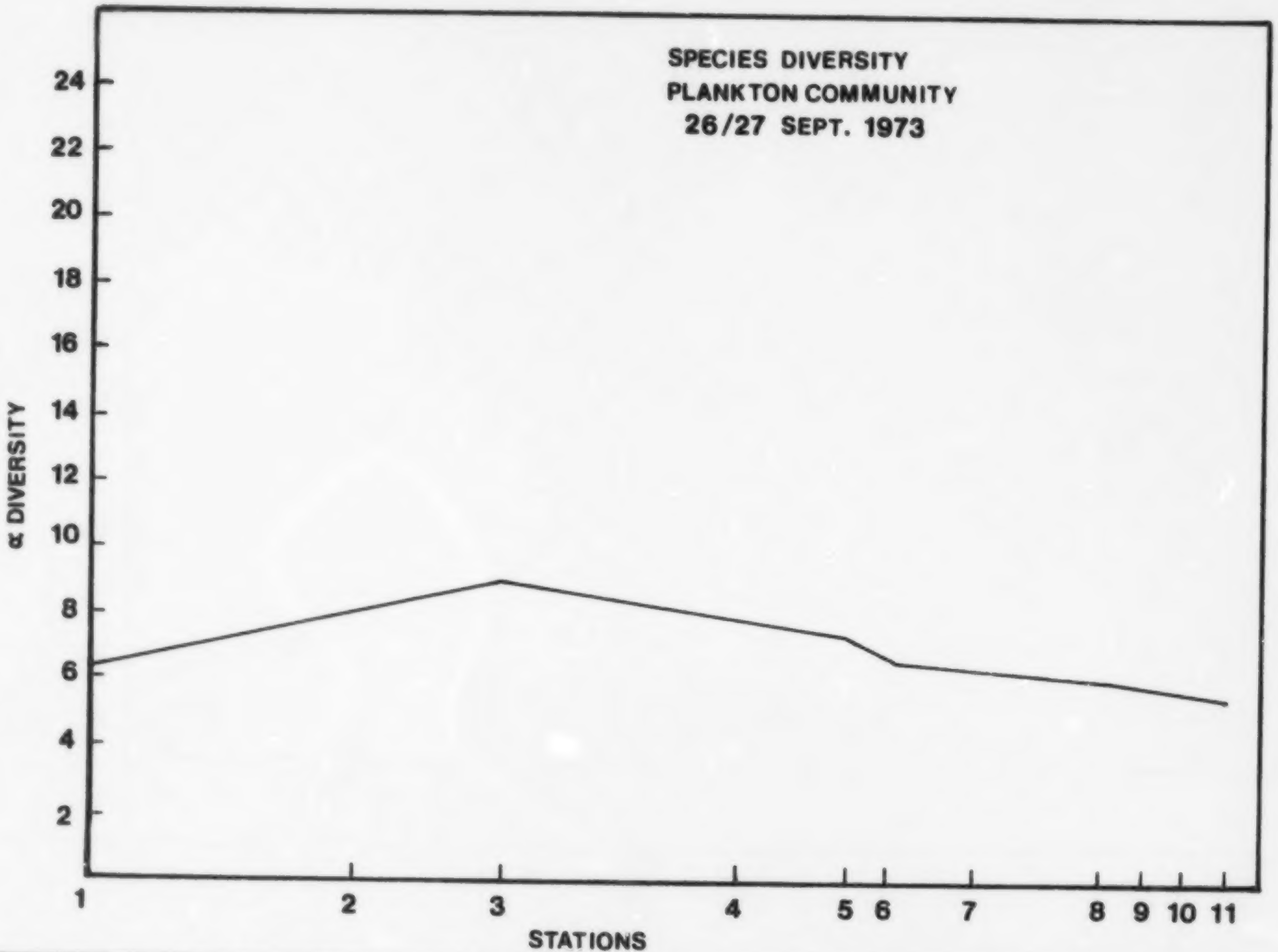


Figure 23 Species diversity - plankton community 26-27 September 73

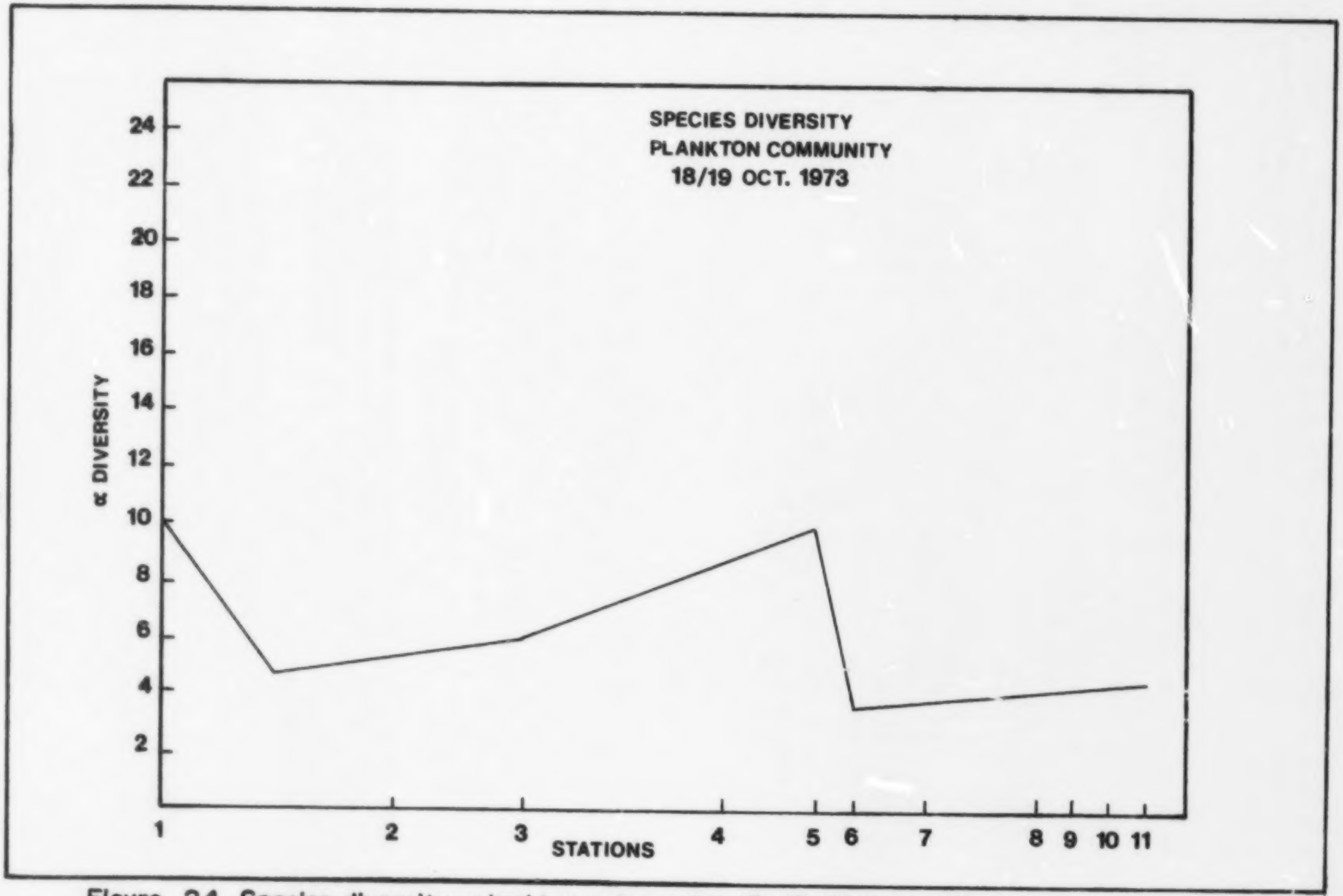


Figure 24 Species diversity - plankton community 18-19 October 73

In the September 26 sampling, the total number of plankton remained relatively constant. Again diatoms and green algae were dominant types. The diversity indices decreased at stations in the lower river. This was due to an increase in the green algae found at those stations.

Samples taken on October 19 had lost almost all blue-green algae component and had a large proportion of diatoms and green algae. These samples were taken from the river where water temperatures ranged from 10.3°C at Station 1 to 15.5°C at Station 11. These cooler temperatures favor the development of diatom populations.

Nutrient levels of nitrogen and phosphorus were always high enough to support good populations of phytoplankton. Conditions which would limit phytoplankton numbers include turbidity, zooplankton grazing, toxic substances and low temperatures. Zooplankton populations did not appear to be sufficiently large enough to reduce phytoplankton numbers. Water temperatures, pH and other physical factors were well within the range of biological requirements for growth. Only turbidity would appear to limit growth of phytoplankton. Turbidity was not measured in this study. However, the Genesee River drains land used for various agricultural activities which would contribute to the silt load of the river. This added turbidity in the form of silt significantly reduces the available amount of light for photosynthesis by phytoplankton.

The synergistic effects of heavy metals on growth of phytoplankton is not well known. Occasionally relatively high concentrations of copper (0.14-0.16 ppm), iron, barium, and chromium were found at Station 11. These were probably from an industrial discharge in that portion of the river.

BENTHIC POPULATIONS

Benthos, organisms which live on or near the bottom of a lake or river, include representatives of nearly every taxonomic group which occurs in freshwater(43). Benthic invertebrates feed primarily on plankton and detritus, however some species are predaceous. They in turn are primary constituents of some vertebrates. Besides being an important link in the food chain, benthic organisms are good "indicators" of water quality. With the exception of the insect larvae which hatch, most benthic organisms spend their life in the sediment or attached to a firm substratum. Thus, they reflect the quality of the water which flows over them. As discussed later in this section, some benthic species such as Olichaetes are able to tolerate adverse conditions while other species cannot.

Tables 16-20 in Appendix C present the average number of organisms per square meter for each station on each sample date. The Oligochaeta, and Chironomidae are by far the most abundant groups. The Oligochaeta are the most consistently represented throughout the sample period. The Chironomidae are the most abundant and the most diverse during August and September.

The diversity was plotted for each sample period in Figures 25 through 28. Along with a plot of the log of the total number of organisms per square meter at each station. The bottom half of each figure indicates the percent composition of the Chironomidae, Oligochaeta and other organisms at each station. The three parameters can be compared simultaneously for each of the four sample periods. The relative distances of each of the stations is indicated on the abscissa of each graph by the spacing of the station numbers.

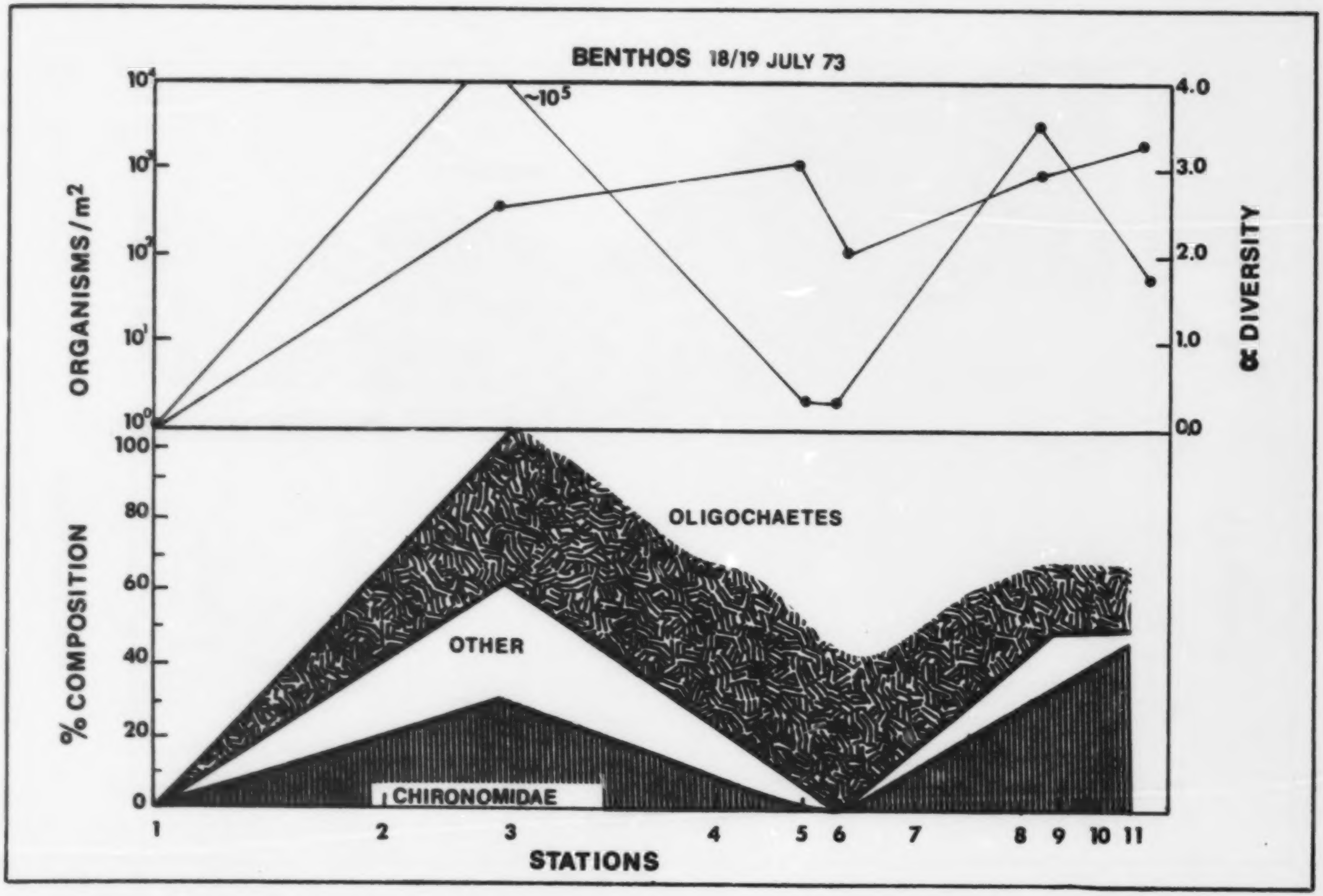


Figure 25 Benthos 18-19 July 73

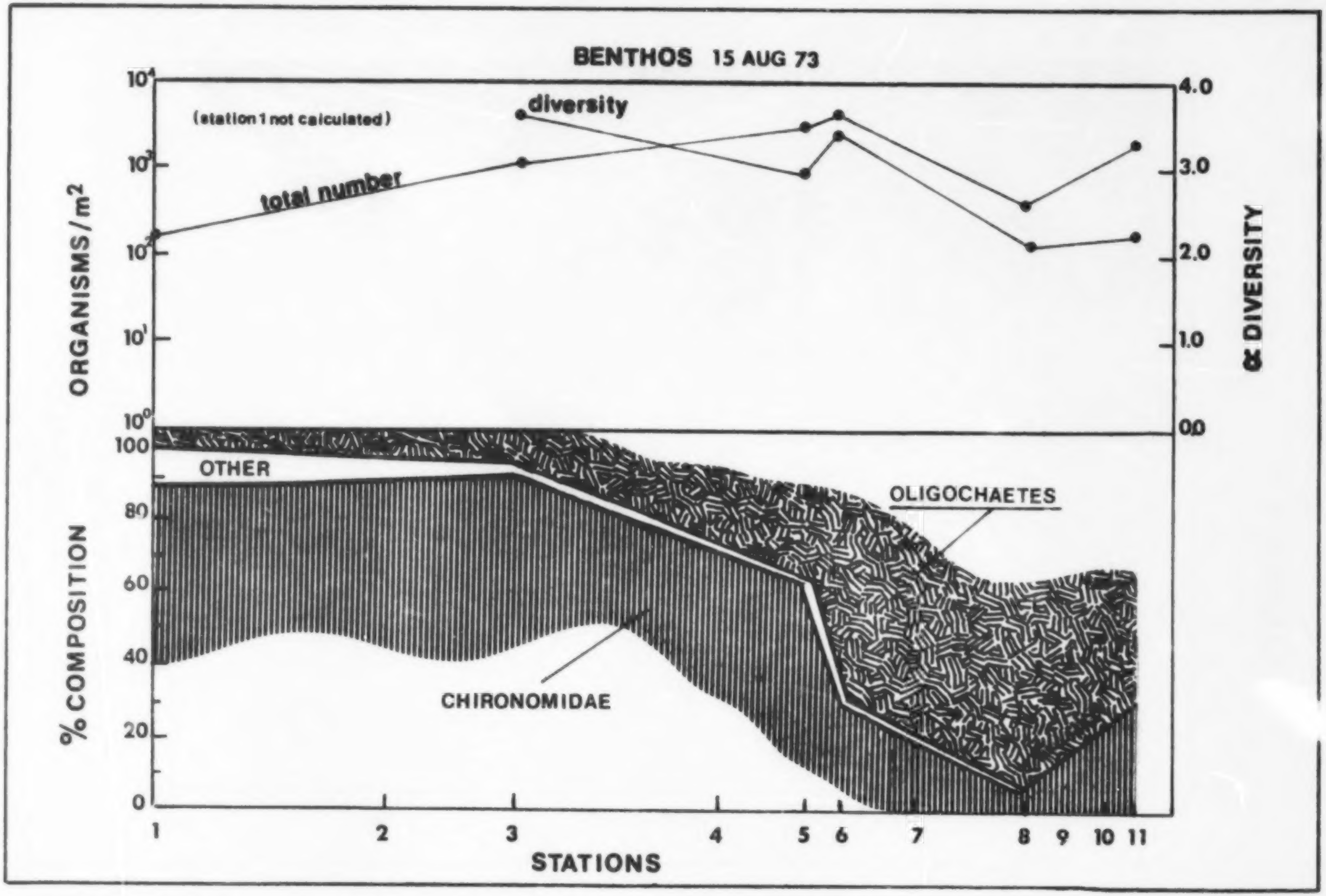
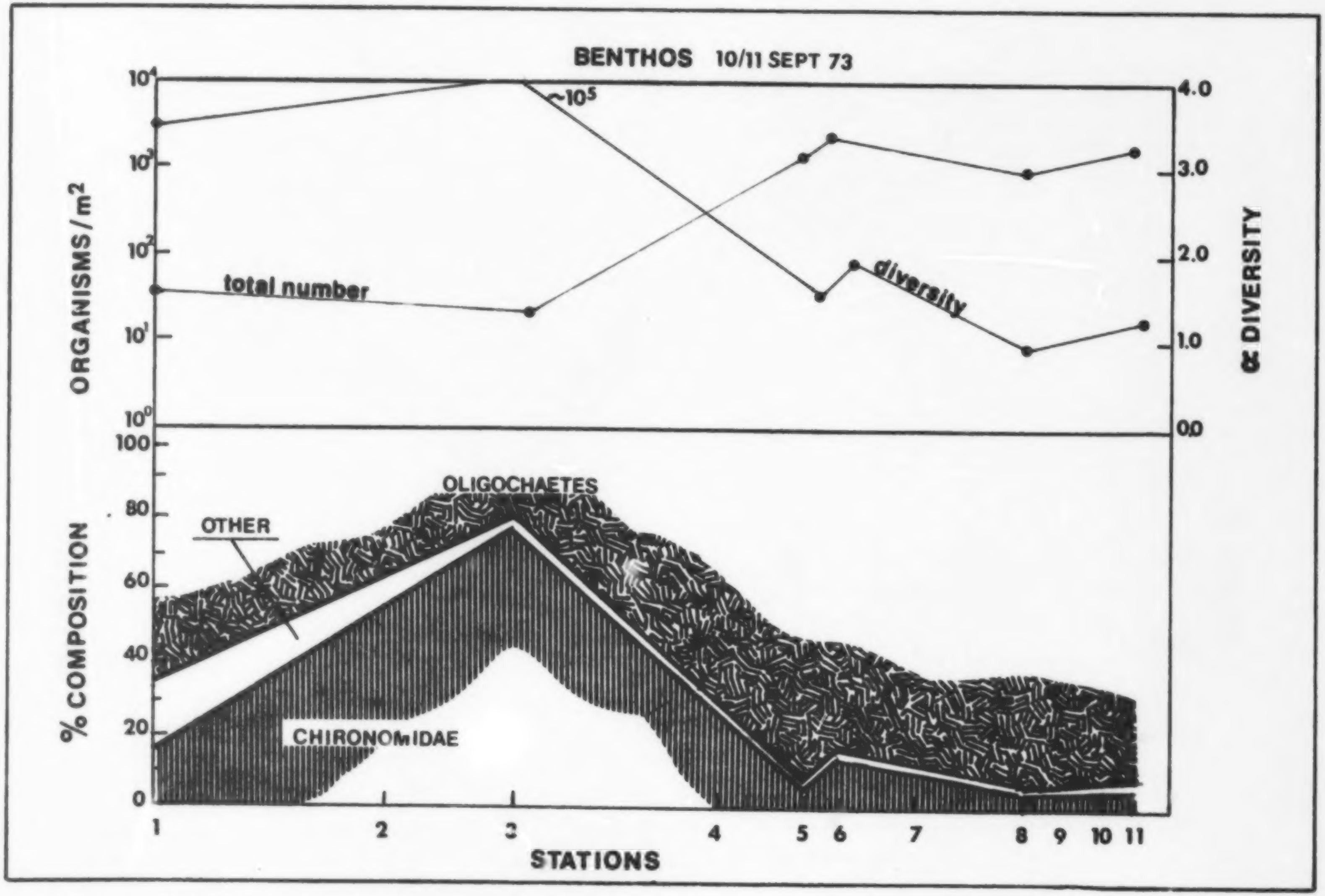


Figure 26 Benthos 15 August 73



BENTHOS 10/11 SEPT 73

Figure 27 Benthos 10-11 September 73

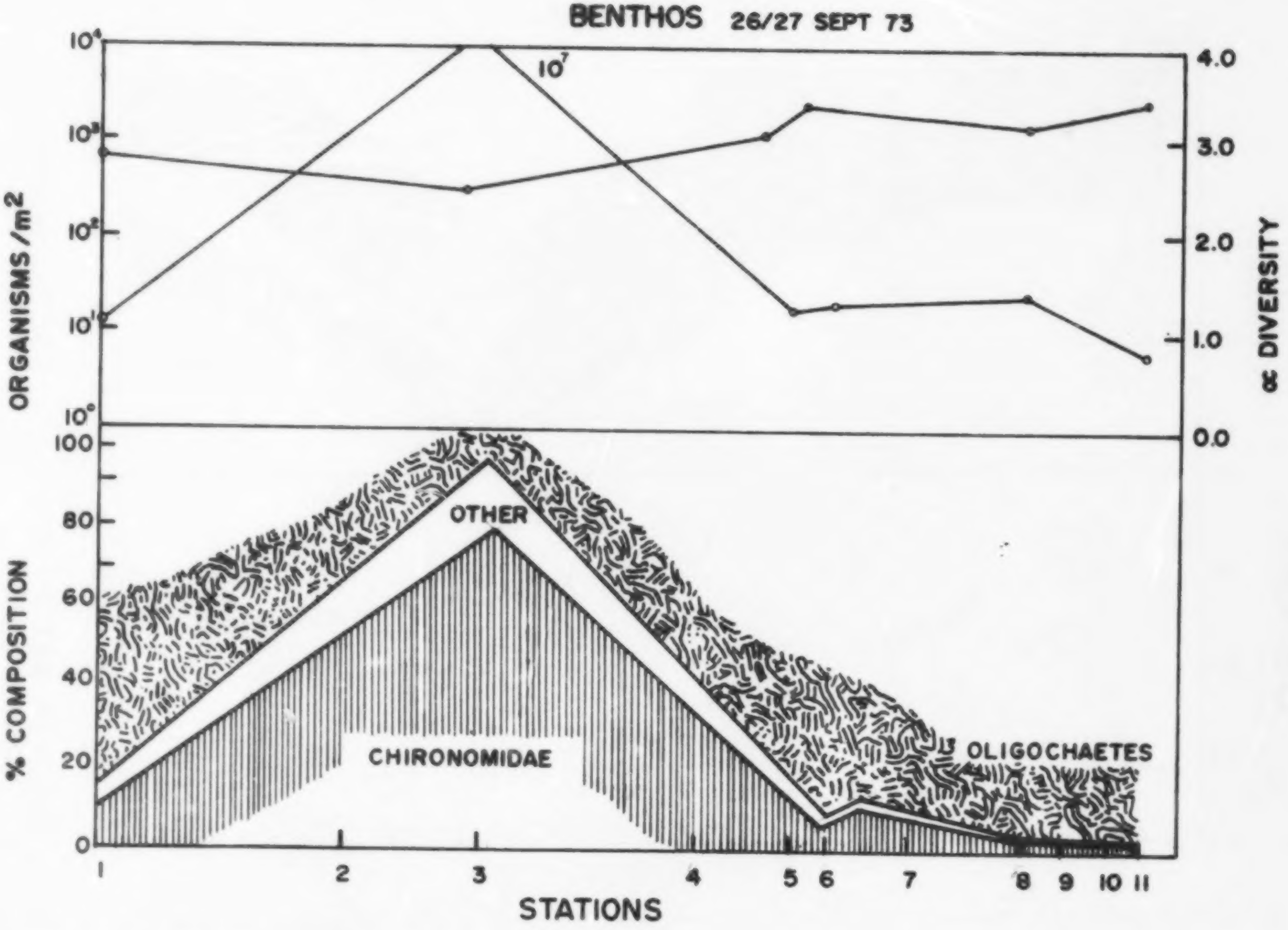


Figure 28 Benthos 26-27 September 73

The Chironomidae were the predominant organism at Station 3 during all four sample periods. Station 1, the farthest upstream, yielded numbers of organisms too low to allow definite interpretation. Stations 5, 6, 8 and 11 showed a very clear reversal with the reduction of the Chironomidae and other organisms, and the dominance of the Oligochaeta. The diversity values were highest at Station 3 on all of the dates. The proportions of the three categories or organisms were the most evenly distributed at this station, a factor which would tend to contribute to a higher diversity. The high diversity values at Station 3 should be interpreted with some caution. The combination of a low total number and high number of species and 3 sample dates, require estimation of the index from the graph provided on page 52, of Fisher, Corbet and Williams(39). The standard error of these estimates tends to be rather large.

There was an increase in the number of Chironomidae, mostly *Cryptochironomus* at Stations 5 and 6 during August 15. This may be explained in part by the carnivorous nature of some *Cryptochironomus* which have been reported feeding on Oligochaets(46) in polluted waters. The increased number of species of these Chironomidae (present in low numbers) was overshadowed by the total number of Oligochaeta represented by comparatively few species, although the diversity did jump suddenly between Stations 5 and 6 on this date, and also on September 10/11.

There was marked similarity for all three parameters; percent composition, total number, and diversity for the September 10/11 and September 26/27 samples. Most of the seasonal variation appeared to occur during the July 18/19 through August 15 period. Since the Oligochaeta were the only group consistently represented in most of the samples, this group was used in an analysis of variance of total number per sample for the four sample dates and the six stations. Since numbers of invertebrates from bottom samples are generally not normally distributed, a log (y + 1) transformation was employed to normalize the data for Oligochaetes(47). The transformed data was entered into a 4 by 6 table with three replications for each station and sample date.* A two way analysis of variance with replication(48) was employed to test for significant differences in numbers of Oligochaetes between dates and stations. The test revealed a highly significant difference between stations ($F_s = 47.6$, P .01), and also between dates ($F_s = 14.4$, P .01). A significant interraction variance component could also be demonstrated ($F_s = 6.4$, P .01), indicating considerable relation between station and date with regard to the number of Oligochaetes present. The number of Oligochaetes present at a particular station is, in other words, *not* independent of the date of sampling. The variance component between stations, was by far the largest, suggesting that the differences between stations are greater than the differences due to seasonal fluctuations. There was a general increase in numbers of Oligochaetes between July 18 and 19, with the highest values occurring at Stations 5 and 11 (as indicated by the marginal totals of the variance analysis table). These results correspond well with those shown in Figures 25 to 28.

Except for a sudden increase at Station 8 on July 18, the overall trend of the diversity values was a decrease between Stations 3 and 11. The decrease in diversity was especially pronounced where the Oligochaetes reached 90% or more of the total abundance during each sample period. At the same time the total number of organisms increased considerably.

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* Two replicates were taken at Stations 3 and 11, July 18/19. The value of the missing replicate was estimated by calculating the mean of the two replicates taken.

High diversity (large proportion of species to total number of organisms in the sample) is generally considered an indication of a healthy, stable, clean water environment, while a low diversity is considered a sign of artificial eutrophication, or poor water quality. An increase in the Oligochaete fauna at the expense of other invertebrates can also be considered an indication of water quality deterioration(49,50,51).

Beginning with Station 5, according to these criteria, the water quality has deteriorated considerably. Stations 8 through 11 are within the city of Rochester, and this result is not unexpected for a large urban area. A general decrease in dissolved oxygen from Stations 1 to 11, indicated in Section IV of this report, supports a picture of increased nutrient and organic waste loading, and an increasingly unfavorable environment for any organism but the sludge worm.

FISH

Only one sample of Fish was analyzed from the Genesee River. The trawl used for collection arrived late. After collection, fish were transported to the laboratory where samples were frozen for later analysis. Failure of the freezing unit resulted in spoilage of the fish which rendered them unfit for analysis.

Table 11 compares species of fish found in Lake Ontario and the Genesee River during this survey. Alewifes were found in the lower parts of the river. Presumably they had their origin in Lake Ontario. Carp were found only at Stations 5, 6, 8 and 11. These stations may have high turbidity or other conditions which favor the existence of carp (Table 21, Appendix C). Oxygen profiles at each station (Figure 29 through 35) show high dissolved oxygen concentrations at all surface stations. These concentrations never fell below 4.0 ppm. Dissolved oxygen concentrations for samples of water close to the bottom were low for Stations 9, 10, and 11 on August 2. Samples were taken following dredging operations in Rochester Harbor. The dredge stirred up the bottom sediment, which apparently created anaerobic or near anaerobic conditions.

The one sampling of fish is too small to justify firm conclusions, however the distribution of fish tends to support plankton and benthic data. All these data suggest better water quality at Stations 1 through 5 and a decrease in quality on the lower river. A dividing point seems to be the intersection of the Genesee River with the Erie Canal.

A general description of the types of fish observed in this survey can be found in Appendix C.

Table 11. Fish Species in Lake Ontario and the Genesee River

Species	Lake Ontario	Genesee River
Anquiilidae		
Anquilla rostrata (American Eel)	+	–
Clupidae		
Alosa pseuelohareugus (Alewife)	+	+
Dorosoma cepedianum (Gizzard Shad)	+	–
Osmeridae		
Osmerus esperlantus (Smelt)	+	–
Cyprinidae		
Cyprinius carpio (Carp)		
Notemogonus chrysoleucas (Golden Shiner)	+	+
Notropis hudsonius (Spottail Shiner)	+	+
Catostomidae		
Catostomus commersoni (White Sucker)	+	+
Ictaluridae		
Ictalurus nebulosus (Brown Bullhead)	+	+
Gasterosteidae		
Gasterosteus aculeatus (Threespine Stickleback)	+	–
Cottidae		
Cottus bairdi (Mottled Sculpin)	+	–
Serranidae		
Roccus americana (White Perch)	+	+
Centrarchidae		
Micropterus dolumieui (Smallmouth Bass)	+	+
Ambloplites roprestris (Rock Bass)	+	+
Lepomis macrochirus (Bluegill)	+	+
Lempomis gibbosus (Pumpkinseed)	+	+
Percidae		
Perca flavescens (Yellow Perch)	+	+
Etheostoma nigrum (Eastern Johnny Darter)	+	+
Stizostedion vitreum (Walleye)	+	+

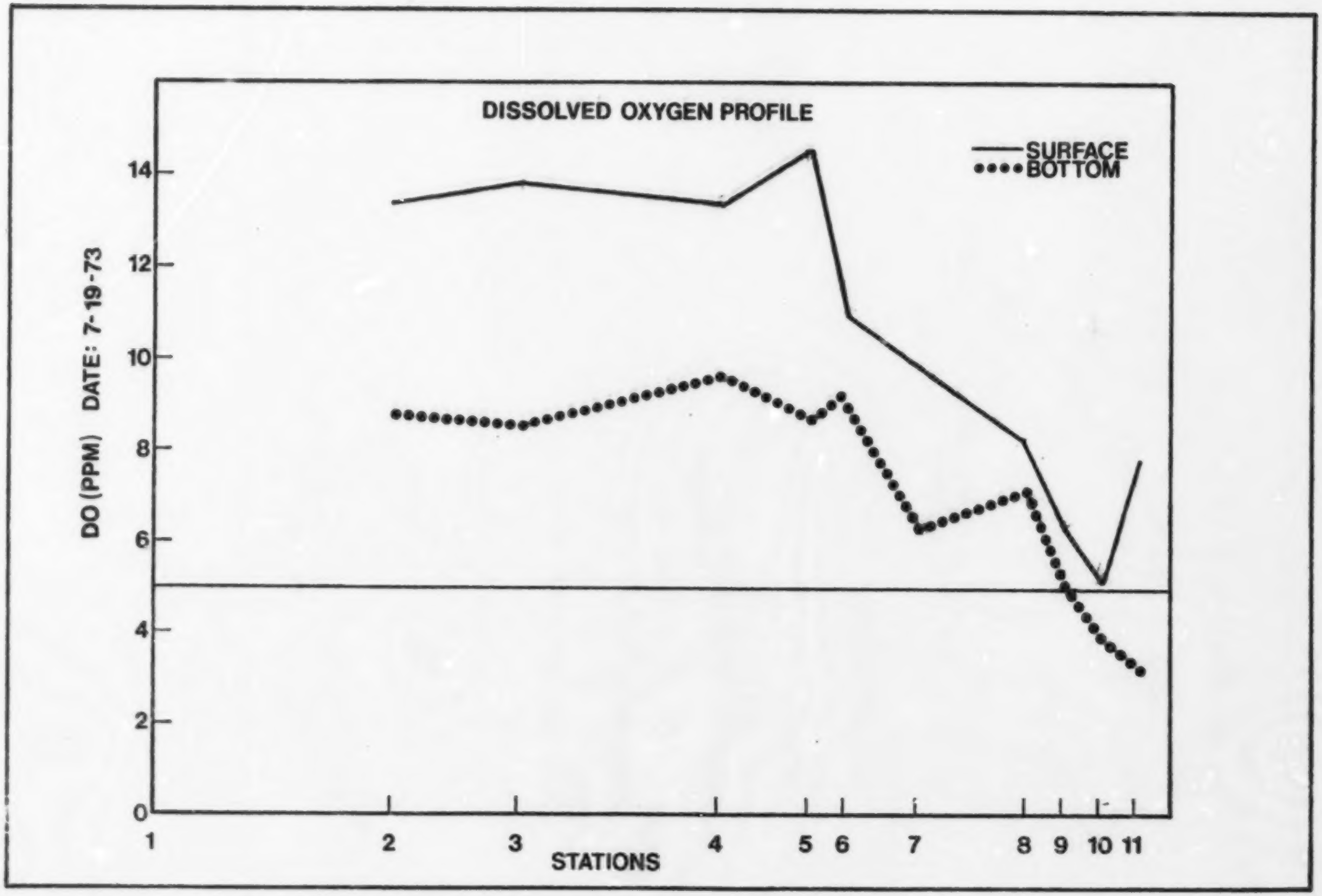

Figure 29 Dissolved Oxygen Profile 19 July 73

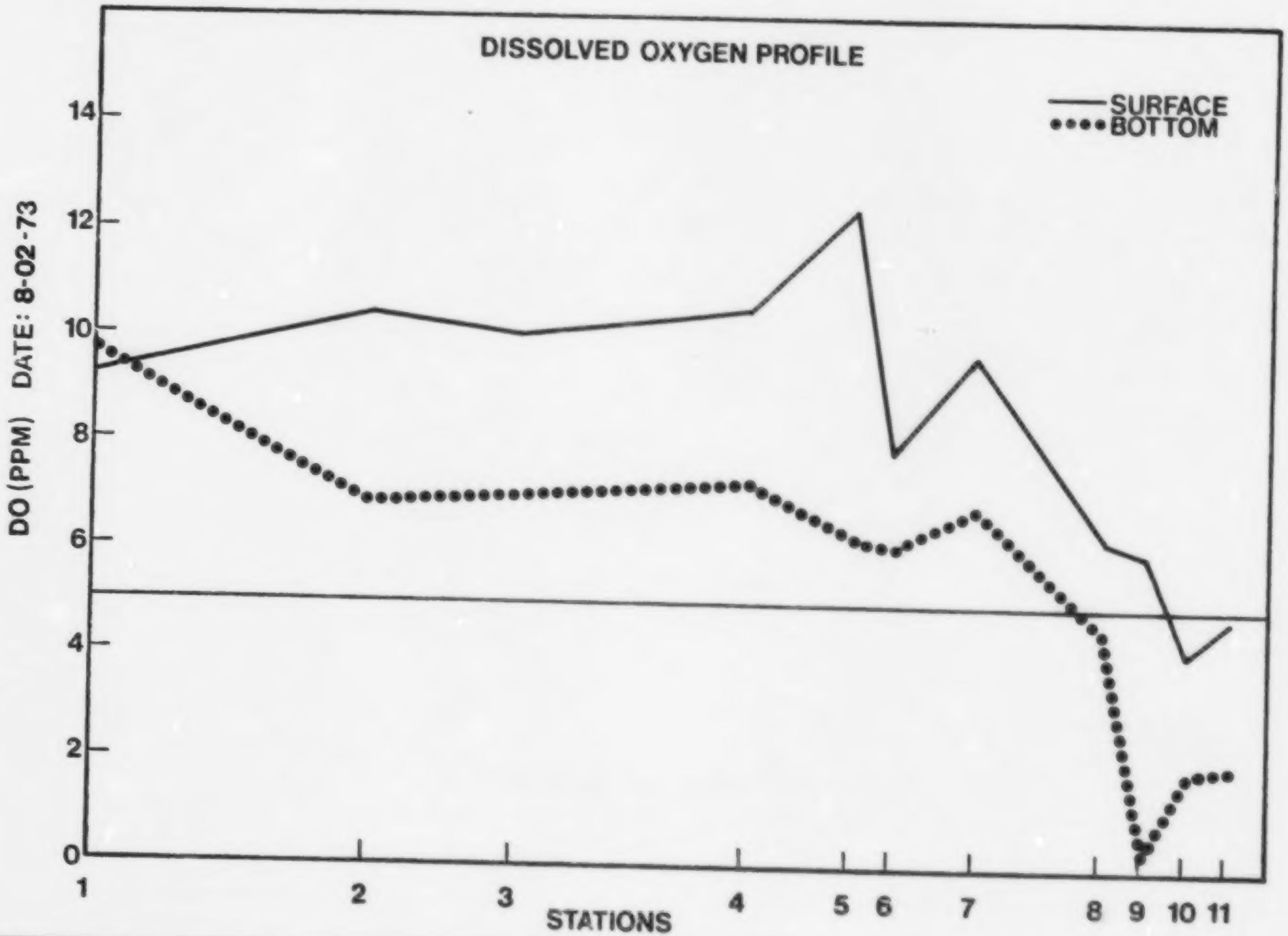

Figure 30 Dissolved Oxygen Profile 2 August 73

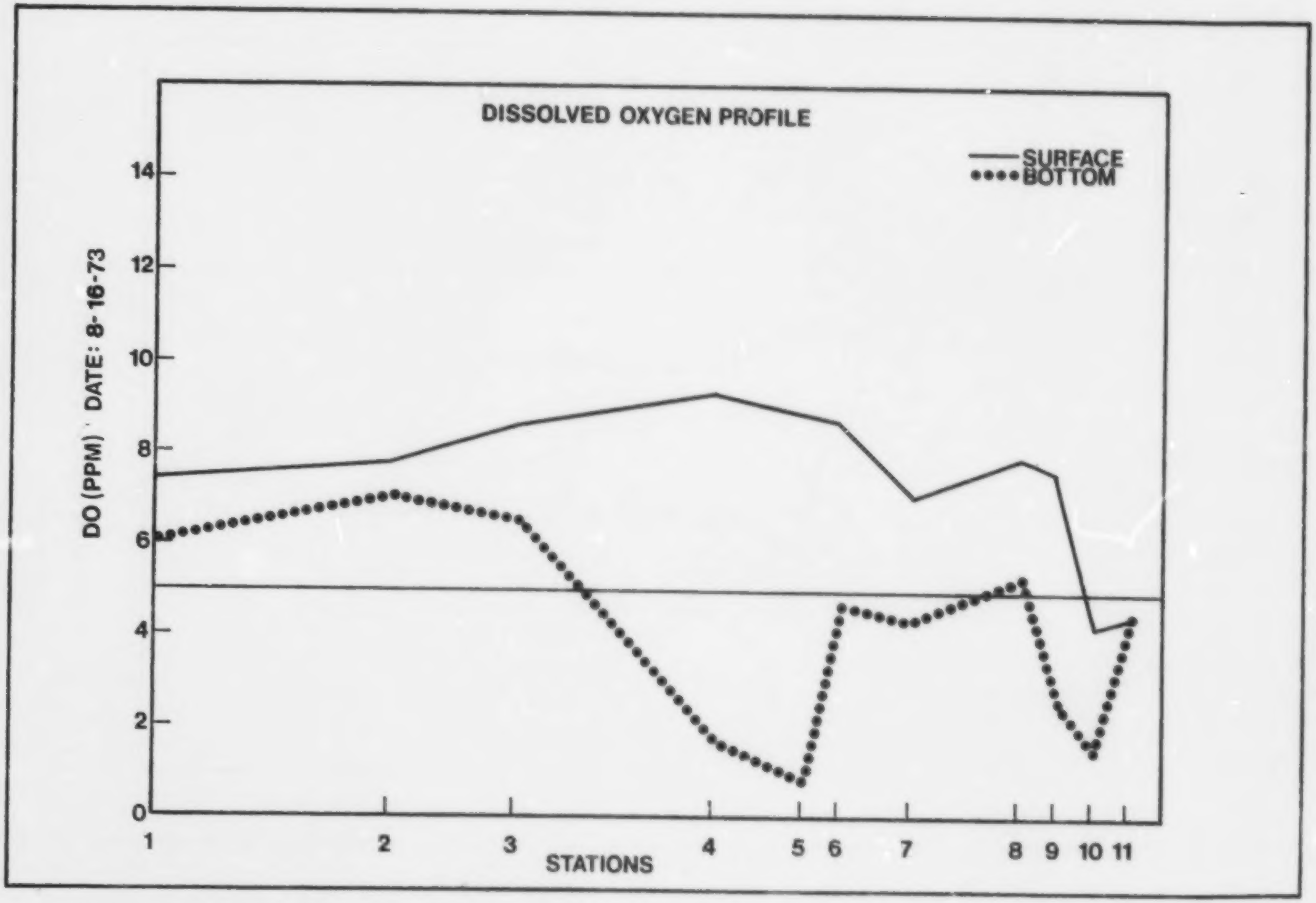

Figure 31 Dissolved Oxygen Profile 16 August 73

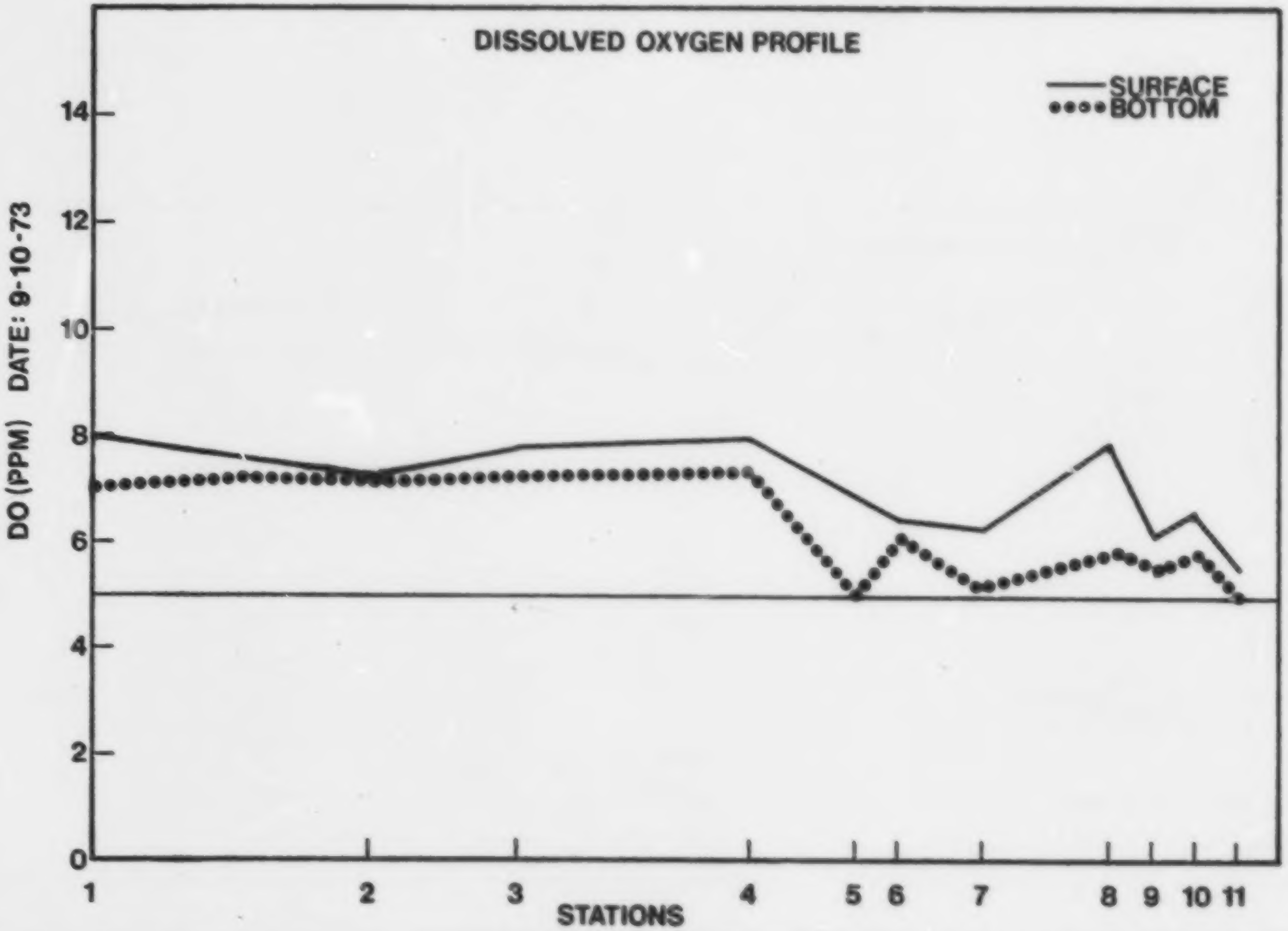

Figure 32 Dissolved Oxygen Profile 10 September 73

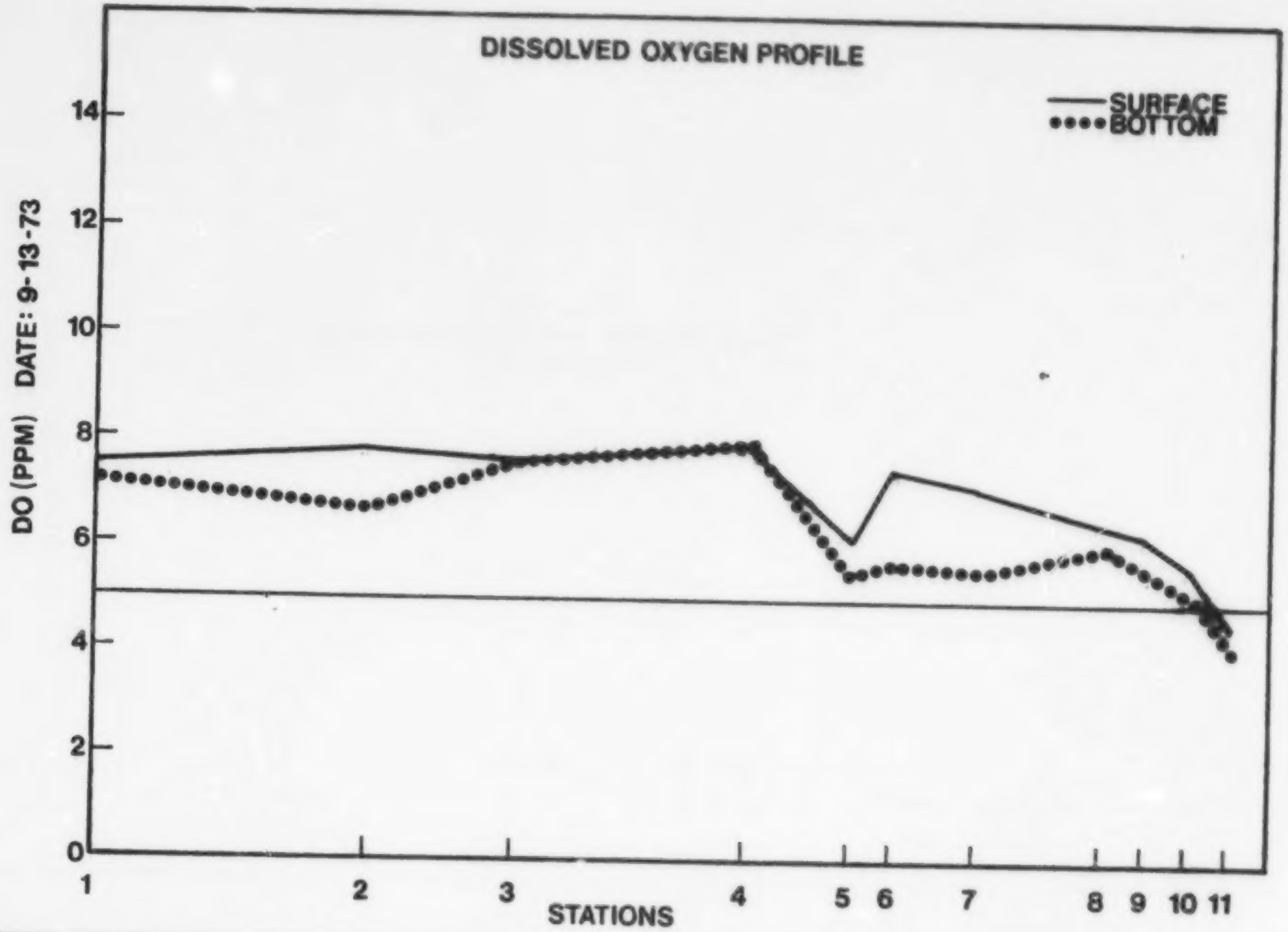

Figure 33 Dissolved Oxygen Profile 13 September 73

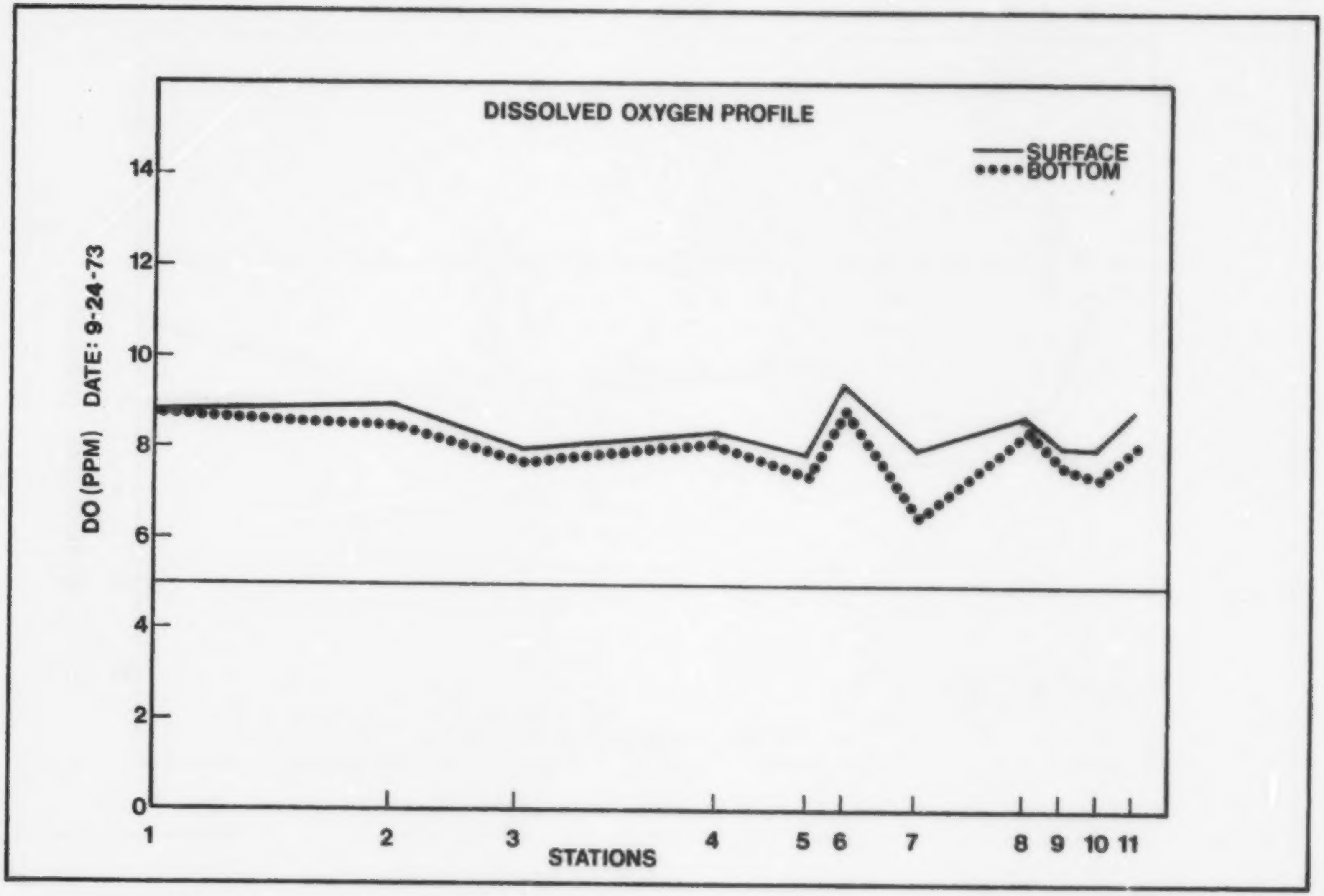

Figure 34 Dissolved Oxygen Profile 24 September 73

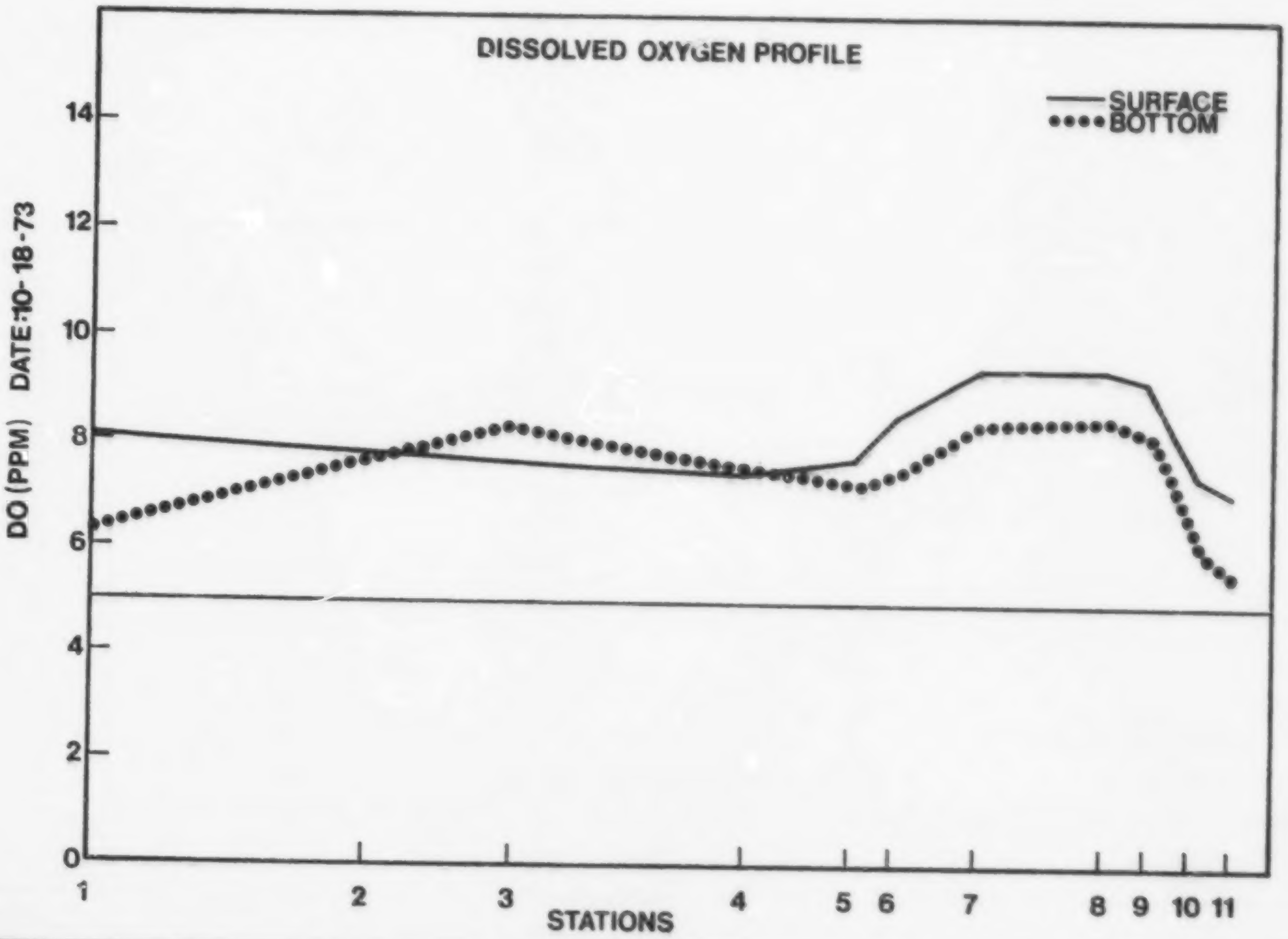

Figure 35 Dissolved Oxygen Profile 18 October 73

SECTION VII

DEVELOPMENT OF THE ASSIMILATION CAPACITY MODEL

MATHEMATICAL FORMULATION

In formulating a mathematical expression of the Stream Assimilation Capacity for the Lower Genesee River Basin, a modified form of the Streeter-Phelps equation was employed. The more common form of the Streeter-Phelps equation made no distinction between the oxygen-demanding pollutants in the form of organic carbon (carbonaceous demand) and oxygen-demanding pollutants in the form of reduced nitrogen species (nitrogenous demand). Since such a distinction was desired for this study because of the high concentrations of reduced forms of nitrogen found in the stream, a modified form of the basic equation was necessary. In addition to the distinction between carbonaceous and nitrogenous demand, an effort was also made to incorporate a mathematical description of both benthic demand and estuarine induced dispersion effects due to the effect of Lake Ontario on the lower reaches of the River. The following describes the modifications made to the Streeter-Phelps equation.

Interactions of the mechanisms producing oxygen deficits are very complex and highly variable at any given time and place. Affecting these mechanisms are such physical processes as settling, scouring, oxygen stripping and dilution. Also natural biological activity such as photosynthesis, atmospheric oxygen replenishment, algal respiration, and benthal demands may significantly affect the dissolved oxygen concentrations in the stream. Geophysical characteristics affecting the assimilation capacity of the stream include cross-sectional area, depth, flow and temperature.

The more common form of the Streeter-Phelps equation is:

$$D = \frac{K_1 L_o}{K_2 - K_1}\left[e^{-K_1 t} - e^{-K_2 t}\right] + D_o e^{-K_2 t}$$

where D = oxygen deficit (mg/l)

K_1 = deoxygenation coefficient (1/day)

K_2 = reoxygenation coefficient (1/day)

L_o = ultimate oxygen demand (1 mg/l) at $t = o$

D_o = initial oxygen deficit (mg/l) at $t = o$

t = time (days)

In the above form of the equation, it is assumed that all of the oxygen deficit is due to a total oxygen demand made up of carbonaceous and nitrogenous demands. Since the effect on the deficit does not distinguish between the demand caused by carbonaeous material (CBOD) and the demand caused by nitrogenous material (NOD), the Streeter-Phelps equation was modified to the following equation:

$$D = \frac{K_1 L_1}{K_3 - L_1}\left[e^{-K_1 t} - e^{K_3 t}\right] + \frac{K_2 L_2}{K_3 - K_2}\left[e^{-K_2 t} - e^{-K_3 t}\right] + D_o e^{-K_3 t}$$

where D = oxygen deficit (mg/l)

K_1 = deoxygenation coefficient due to CBOD (1/day)

K_2 = deoxygenation coefficient due to NOD (1/day)

K_3 = reoxygenation coefficient (1/day)

L_1 = oxygen demand due to CBOD (mg/l)

L_2 = oxygen demand due to NOD (mg/l)

D_o = initial oxygen deficient (mg/l) at $t = o$

t = time (days)

Since it was also desired to include an estuarine coefficient in the equation for the last downstream stations, "j" terms were incorporated such that:

$$jx = K_x/E$$

where j_x = oxygenation coefficient (1/day) for estuarine effect

V = velocity of flow (mi/day)

K_x = oxygenation coefficient (1/day)

E = estuarine coefficient (mi 2/day)

The above modifications resulted in the following equation:

$$D = \frac{K_1L_1}{K_3-K_1}\left[e^{-jit} - e^{-j3t}\right] + \frac{K_2L_2}{K_3-K_2}\left[e^{-j2t} - 3^{-j3t}\right] + D_oe^{-j3t}$$

In the upper reaches of the stream, the estuarine coefficient was not applied. In such cases when $E = O$, $j_x = K_x$.

From initial application of the data to the above equation, it was found that a significant difference in DO level between the values computed and the values actually measured existed in the stretch of the river downstream of the last falls. This DO difference was assumed to be due to oxygen-demanding material in the benthos of the stream. Thus a benthic factor was assigned to the equation to account for the deviation between computed and measured data. Thus the final form of the equation used in this study is as follows:

$$D = \frac{K_1L_1}{K_3-K_1}\left[e^{-jit} - e^{-j3t}\right] + \frac{K_2L_2}{K_3 - K_2}\left[e^{-j2t} - e^{-j3t}\right] + D_oe^{-j3t} + BA$$

where B = benthic demand factor (mg/l/square mile)

A = area of stream bottom, (square miles)

STREAM COEFFICIENTS

The deoxygenation coefficient K_1 in the typical Streeter-Phelps equation is determined under standard laboratory conditions by incubating a stream sample in a BOD bottle and analyzing the sample for dissolved oxygen concentration after selected time intervals. This coefficient is taken to represent the rate at which the total oxygen demand of the sample is stabilized. In the course of this study, the deoxygenation rate was separated into two rates that represented the carbonaceous oxygen demand rate K_1, and the nitrogeneous oxygen demand rate K_2. The method employed in calculating each demand is discussed below.

The nitrogeneous materials in a stream utilize oxygen according to the following equations:

1. $\text{Organic N} + \frac{\text{bacteria}}{\text{hydrolysis}} \longrightarrow NH_3$
2. $2NH_3 + 3O_2 \xrightarrow{\text{bacteria}} 2\,NO_2^- + 2H^+ + 2H_2O$
3. $2NO_2^- + O_2 \xrightarrow{\text{bacteria}} 2\,NO_3^-$

Each pound of organic and ammonia nitrogen that proceeds through the above reactions requires 4.5 pounds of oxygen as compared to the 1-2 pounds of oxygen required for carbonaceous BOD. The ultimate nitrogeneous demand is therefore calculated by multiplying the sum concentrations of organic nitrogen and ammonia nitrogen by 4.5 to determine an equivalent oxygen demand. In the laboratory, ultimate BODs (BOD_{28}) had been set up to determine an ultimate oxygen demand exerted on the river. By subtracting the ultimate NOD from the total ultimate demand, the ultimate CBOD was determined. By then applying the "Graphical Method" for determining deoxygenation coefficient as developed by Thomas,(73) the deoxygenation coefficients of NOD and CBOD were determined for each reach of the study area and are listed in Table 12.

In this modeling effort, projections were made by using average stream coefficients as computed over the eight sampling dates, rather than using coefficients derived from one particular sampling. The use of one sampling for determining deoxygenation coefficients can reflect anomalies not applicable to other samplings. The purpose of more sampling was to dampen out any day-to-day anomalies and to avoid reflecting them in projections of future conditions (See Figures 52 and 53).

The reoxygenation coefficient, designated K_3 in this study, was calculated for each reach of the River by the standard O'Connor formula and are shown on Table 13.

$$K_3 = \frac{(D_L V)^{1/2}}{H^{3/2}}$$

K_3 = reoxygenation coefficient (1/day)

D_L = diffusivity of oxygen in water

8.1×10^{-5} ft^2/hr @ 20°C

V = velocity of flow, (ft/hr)

H = average depth of flow, (ft)

The estuarine coefficient "E" was calculated from a formula developed by O'Conner(74) which provided a means of calculating the concentration of a conservative parameter at a distance downstream from the source of the parameter:

$$S = So\ e^{\frac{-VX}{E}}$$

where S = concentration downstream a distance X

S_o = initial concentration at distance X = O

V = Velocity of flow

X = distance

E = dispersion coefficient

Rearranging the terms yields

$$E = -\frac{VX}{\log S/So}$$

Table 12. Deoxygenation Coefficients at Each Station

Location	Deoxygenation Co-efficients day^{-1} (base e)	
	K_1	K_2
Station 1	.080	.075
Station 2	.080	.075
Station 3	.080	.075
Station 4	.067	.060
Station 5	.070	.063
Station 6	.070	.063
Station 7	.070	.063
Station 8	.090	.084
Station 9	.090	.084
Station 10	.090	.084
Station 11	.085	.101

Table 13. Reoxygenation Coefficients at Each Station

Location	Measured Avg. Velocity ft./hr.	Reoxygenation Co-efficients day^{-1} (base e)
Station 1	1840	.208
Station 2	1605	.208
Station 3	1590	.318
Station 4	1605	.208
Station 5	1560	.205
Station 6	1605	.208
Station 7	1550	.210
Station 8	1830	.210
Station 9	1615	.155
Station 10	1640	.120
Station 11	1720	.047

The velocities applied in this study were obtained by Gurley Meter measurements made at the time of each sampling. The conservative parameter in this case was dye used in time-of-travel studies by NYSDEC.(75) The value of the dispersion coefficient "E" was calculated to be approximately 10.0 sq. mi./day. This value compares favorably with a value of 9.4 sq. mi./day as calculated by O'Connor(74) for a tidal river.

Since time did not permit an extensive sampling program to be conducted to determine the actual benthic oxygen demand, an approximation of its value was made in the following manner and reported in oxygen depletion per unit bottom area (mg/l/sq. mile). Knowing the difference between observed and computed dissolved oxygen and assuming that this difference was due to a benthic loading, the loading was calculated by dividing the difference between observed and computed DO readings by the river bottom area to yield mg/l/sq. mi. The area of stream bottom was determined from U.S. Army Corps of Engineers cross-section data and depth charts of the lower Genesee River. The average resulting benthic loading was found to be 0.75 mg/l/sq. mi. When this value is converted into more conventional units, the results for flows in the range of 300-600 MGD area as follows.

$$0.345 - 0.575 \text{ g/day/m}^2$$

These values are in the general range of 0_2 uptake rates (for a river) as determined in previous studies listed below.

Investigator	0_2 Uptake g/day/m^2
Martin & Bella (76)	1.9 - 3.4
McKeown, et. al. (77)	2.7 - 4.4
Baity (78)	1.8 - 5.4
Fair, et. al. (79)	1.2 - 4.6
Hanes & Irving (80)	1.4 - 1.5

One reason that the uptake rate as approximated in this study is somewhat lower than previous studies indicated is due to the fact that the Corps of Engineers periodically dredges the lower Genesee River causing some siltation after dredging to cover up organic matter than would exert an oxygen demand on the overlying waters. Estuarine effects also decrease benthic effects.

DATA SOURCES AND FORMULATION

For the Genesee River study area, the river was subdivided into reaches such that the beginning of each reach coincided with a point-source loading. Therefore, 20 reaches were established to include the major combined sewer overflows in the City of Rochester. The locations of these point-source discharges are listed below:

Reach	Name	Mile Pt.
1	Initial	34.70
2	Avon STP	34.40
3	Honeoye Creek	26.70
4	Oatka Creek	22.40
5	Scottsville Svc. Area	20.20
6	Black Creek	14.10
7	GCO STP	13.70
8	Barge Canal	11.40
9	Brooks SW	10.70
10	Plymouth SW	10.30
11	Court SW	8.30
12	Central SW	7.55
13	Mill-Factory SW	7.15
14	Bausch & Lomb	6.95
15	Carthage SW	6.45
16	Lexington SW	5.95
17	Seth Green SW	5.45
18	Maplewood SW	4.75
19	Kodak STP	4.30
20	Iron-St. Paul STP	0.70

The values of the various parameters used as input for each of the point-source loadings deserves some discussion. The oxygen demand parameters BOD, NH_3N and Organic N for the tributaries Honeoye, Oatka, and Black Creeks and the Barge Canal were obtained from the N.Y.S. Department of Environmental Conservation Water Quality Surveillance Network data for the years 1967 - 1970.(3) Under average conditions the values of the above parameters were taken from the 50% percentile while for the minimum average flow conditions, the values were taken from the 90% percentile. The values of the dissolved oxygen for average and minimum flow conditions were taken from the 50% percentile and the 10% percentile, respectively.

At point-source loadings other than the tributaries (municipal and industrial discharges) the loadings were determined from actual effluent data averaged over the period January, 1972 to May, 1973 or from industrial discharge permits prepared by the U.S. Army Corps of Engieers. Loadings from the Rochester Combined Sewer Overflows were estimated from data collected during an existing overflow sampling program being conducted by Monroe County Pure Waters. Dissolved oxygen levels for all point-source discharges were assumed to be 4.00 mg/l, 1.0 mg/l less than the minimum DO value that would meet the Class "B" stream standards for non-trout waters. This value of 4.00 mg/l was assumed to exist under both average and minimum flow conditions. The only exception to the above DO value was in the case of the dry weather overflows where the DO value was assumed to be 2.00 mg/l since most of the dry weather overflows consist of sanitary sewage.

To apply the waste loadings to the computer model, it was first necessary to determine the BOD_u at each point-source location. This was done by multiplying the BOD_5 as obtained from the Surveillance Network data or industrial and municipal effluent data by a factor of 2.5. This 2.5 factor was obtained from BOD uptake studies of the Genesee River and was assumed to apply to the tributaries and municipal/industrial discharges as well, because of similarity between the high percentages of nitrogeneous oxygen demand in both the river and point-source discharges. In addition, it was assumed that the concentrations of the loadings were divided equally between the CBOD and the NOD for sewage treatment plant effluents except at Kodak where good nitrogen data was available. Samples of the treatment plant effluents at Gates-Chili-Ogden Sewage Treatment Plants, Irondequoit-North St. Paul Sewage Treatment Plant and the Avon Sewage Treatment Plant were collected on one occasion and analyzed for several parameters. Nitrogen data for these discharges was later used to determine the actual NOD and CBOD loadings at these point-source discharges.

Flows used in verifying the model were obtained from USGS flow monitoring stations on the dates samples were collected. At the same time, velocity measurements in the Genesee River were made with a Gurley Meter during the sampling program to assist in approximating river travel times between reaches.

SECTION VIII

MODELING PROJECTIONS

GENERAL

The following section of this report deals with the assimilation capacity projections made by applying the model under various conditions of point source loadings and river flows. Cause and effect relationships for key oxygen demand initiating parameters are discussed as well as removal efficiencies required for both municipal and industrial discharges to assure compliance with the stream standards for the Genesee River as established by the New York State Department of Environmental Conservation.

The conditions under which the above subjects are investigated are:

Case IA: Present Loadings Under Average Flow Conditions as Observed in the Course of Conducting the Sampling and Analysis Program

Case IB: Present Loadings Under Conditions of Critical Low Flow (MA7CD/10)

Case IIA: BPCTCA Stipulated Loadings Under Average Flow Conditions

Case IIB: BPCTCA Stipulated Loadings Under Conditions of Critical Low Flow

Resulting dissolved oxygen conditions prevailing under various degrees of treatment for both municipal and industrial discharges are investigated as follows:

	Percent Treatment	
	Municipal	Industrial
Case III:	85	85
Case IV:	90	85
Case V:	95	85
Case VI:	98	85
Case VII:	98	98

In addition to the discharges of municipalities and industries, dry weather overflows from the City of Rochester combined sewer stormwater overflow system are included as untreated wastewater discharges. In none of the conditions noted above was treatment of the overflows considered.

DATA INPUT

Case IA. Present Loading Under Average Flow Conditions

The present loadings from each discharge were determined from actual sewage treatment plant operating data for municipal discharges and from the U.S. Army Corps of Engineers discharge permits for industrial discharges. For the Bausch and Lomb industrial discharge no effluent data was available so a loading was estimated. The present loading from each discharge is shown in Table 14.

Table 14. Present Loadings Under Average Flow Conditions

Discharge	Flow (mgd)	DO (mg/l)	CBOD (mg/l)	NOD (mg/l)
Avon STP	1.00	4.00	87.37	32.63
Honeoye Creek	1.20	8.00	2.17	2.83
Oatka Creek	22.00	10.80	1.00	4.00
Scottsville Svc. Area	0.01	4.00	87.50	87.50
Black Creek	15.00	8.00	2.17	2.83
GCO STP	11.90	4.00	91.30	56.70
Barge Canal	242.00	6.60	5.71	3.27
Court St. SW*	2.00	2.00	22.47	32.51
Bausch & Lomb	0.10	4.00	12.50	12.50
Seth Green SW*	2.00	2.00	164.40	35.60
Maplewood SW*	3.00	2.00	290.00	5.50
Kodak STP	28.00	4.00	35.80	56.70
Irondequoit North-St. Paul STP	1.25	4.00	88.45	58.05

* SW indicates dry weather overflow discharge

** Ultimate Biochemical Oxygen Demand:
CBOD - Carbonaceous component
NOD - Nitrogenous Component

In determining the loadings, it was assumed that the ultimate biochemical oxygen demand loading is divided equally between nitrogenous oxygen demand and carbonaceous oxygen demand unless sufficient data was available to make a detailed assessment of the individual ultimate oxygen demand components. Loadings presented by tributaries to the main stem of the Genesee River within the study area were calculated using the fiftieth percentile BOD value from New York State Department of Environmental Conservation Surveillance Network Data for the period of 1967 to 1970. Dissolved oxygen values for municipal and industrial discharges were set at 4.00 mg/l, 1.0 mg/l below the point at which stream standards would be contravened. Dissolved oxygen values for the tributaries were again obtained from Surveillance Network Data.

Case IB. Present Loadings Under Conditions of Critical Low Flow (MA7CD/10)

As discussed above, the CBOD, NOD, and DO loadings were determined from actual discharge data, discharge permits, and Surveillance Network Data. The flows of the tributaries under MA7CD/10 Yr. conditions were determined from a 1966 study conducted by the New York State Water Resources Commission(81). Table 15 lists the loadings and critical flows of tributaries and discharges to the Genesee River. The oxygen demands of the tributaries were taken from the 10% percentile of the Surveillance Network Data under MA7CD/10 Year conditions.

Table 15. Present Loadings Under MA7CD/10 Yr. Conditions

Discharge	Flow (mgd)	DO (mg/l)	CBOD (mg/l)	NOD (mg/l)
Avon STP	1.00	4.0	87.37	32.63
Honeoye Creek	0.18	6.20	6.30	0.95
Oatka Creek	12.20	9.50	6.92	3.07
Scottsville Svc. Area	0.01	4.00	87.50	87.50
Black Creek	0.57	6.20	3.82	6.18
GCO STP	11.90	4.00	91.30	56.70
Barge Canal	242.00	4.60	5.68	4.32
Court St. SW	2.00	2.00	22.47	32.51
Bausch & Lomb	0.10	4.00	12.50	12.50
Seth Green SW	2.00	2.00	164.40	35.60
Maplewood SW	3.00	2.00	290.00	5.50
Kodak STP	28.00	4.00	35.80	56.70
Irondequoit North-St. Paul STP	1.25	4.00	88.45	58.05

Case IIA. BPCTCA Stipulated Loadings Under Average Flow Conditions

The conditions of BPCTCA as established by EPA showed no significant deviation from present loading of any industrial discharge, but secondary treatment processes (equivalent to 85% removal of TOD) were applied to the treatment of municipal wastewater. The loadings under BPCTCA for average conditions are tabulated in Table 16.

Table 16. BPCTCA Under Average Conditions

Discharge	Flow (mgd)	DO (mg/l)	CBOD (mg/l)	NOD (mg/l)
Avon STP	1.00	4.00	38.75	38.75
Honeoye Creek	1.20	8.00	2.17	2.83
Oatka Creek	22.00	10.80	1.00	4.00
Scottsville Svc. Area	0.01	4.00	87.50	87.50
Black Creek	15.00	8.00	2.17	2.83
GCO STP	11.90	4.00	16.70	16.70
Barge Canal	242.00	6.60	5.71	3.27
Court St. SW	2.00	2.00	22.47	32.51
Bausch & Lomb	0.10	4.00	12.50	12.50
Seth Green SW	2.00	2.00	164.40	35.60
Maplewood SW	3.00	2.00	290.00	5.50
Kodak STP	28.00	4.00	35.80	56.70
Irondequoit North-St. Paul STP	1.25	4.00	44.30	44.30

Case IIB. BPCTCA Stipulated Loadings Under Conditions of Critical Low Flow

The BPCTCA Stipulated Loadings and MA7CD/10 Year tributary flows are tabulated in Table 17. The derivation of the BPCTCA loadings is identical to that previously outlined under Section IIA of this report.

Table 17. BPCTCA Under MA7CD/10 Yr. Conditions

Discharge	Flow (mgd)	DO (mg/l)	CBOD (mg/l)	NOD (mg/l)
Avon STP	1.00	4.00	38.75	38.75
Honeoye Creek	0.18	6.20	6.30	0.95
Oatka Creek	12.20	9.50	6.92	3.07
Scottsville Svc. Area	0.01	4.00	87.50	87.50
Black Creek	0.57	6.20	3.82	6.18
GCO STP	11.90	4.00	16.60	16.70
Barge Canal	242.00	4.60	5.68	4.32
Court St. SW	2.00	2.00	22.47	32.51
Bausch & Lomb	0.10	4.00	12.50	12.50
Seth Green SW	2.00	2.00	164.40	35.60
Maplewood SW	3.00	2.00	290.00	5.50
Kodak STP	28.00	4.00	35.80	56.70
Irondequoit North-St. Paul STP	1.25	4.00	44.30	44.30

Cases III.-VII. Resulting Dissolved Oxygen Conditions Prevailing Under Various Degrees of Treatment for Both Municipal and Industrial Discharges

For various degrees of treatment applied to municipal and industrial discharges, both average and MA7CD/10 Year flow conditions were applied. The loadings associated with each applied degree of treatment are tabulated in Tables 18 through 20. Table 18 shows the tributary and dry weather overflow input data common to all treatment applications under average flow conditions. Table 19 represents the same tributary and dry weather overflow data as shown in Table 19 except MA7CD/10 Year critical low flow conditions are applied. Table 20 lists each municipal and industrial discharge and the loadings associated with each degree of treatment.

Table 18. Input Data Common To All Treatment Applications
Under Average Flow Conditions

Discharge	Flow	DO	CBOD	NOD
Avon STP	1.00	4.00	–	–
Honeoye Creek	1.20	8.00	2.17	2.83
Oatka Creek	22.00	10.80	1.00	4.00
Scottsville Svc. Area	0.01	4.00	–	–
Black Creek	15.00	8.00	2.17	2.83
GCO STP	11.90	4.00	–	–
Barge Canal	242.00	6.60	5.71	3.27
Court St. SW	2.00	2.00	22.47	32.51
Bausch & Lomb	0.10	4.00	–	–
Seth Green SW	2.00	2.00	164.40	35.60
Maplewood SW	2.00	2.00	290.00	5.50
Kodak STP	28.00	4.00	–	–
Irondequoit North - St. Paul STP	1.25	4.00	–	–

Table 19. Input Data Common To All Treatment Applications
Under MA7CD/10 Yr. Conditions

Discharge	Flow	DO	CBOD	NOD
Avon STP	1.00	4.00	–	–
Honeoye Creek	0.18	6.20	6.30	0.95
Oatka Creek	12.20	9.50	6.92	3.07
Scottsville Svc. Area	0.01	4.00	–	–
Black Creek	0.57	6.20	3.82	6.18
GCO STP	11.90	4.00	–	–
Barge Canal	242.00	4.60	5.68	4.32
Court St. SW	2.00	2.00	22.47	32.51
Bausch & Lomb	0.10	4.00	–	–
Seth Green SW	2.00	2.00	164.40	35.60
Maplewood SW	3.00	2.00	290.00	5.50
Kodak STP	28.00	4.00	–	–
Irondequoit North - St. Paul STP	1.25	4.00	–	–

Table 20. Input Data For Municipal And Industrial Discharges Under Various Treatment Applications

	85%		90%		95%		98%	
	CBOD	NOD	CBOD	NOD	CBOD	NOD	CBOD	NOD
Avon STP	38.75	38.75	25.75	25.75	13.00	13.00	8.00	8.00
Scottsville Svc. Area	–	Assume no additional treatment				–	–	–
GCO STP	16.70	16.70	11.20	11.20	5.60	5.60	2.30	2.30
Kodak STP	–	–	–	–	35.80	56.70	8.80	14.10
Irondequoit North - St. Paul STP	44.30	44.30	29.50	29.50	14.80	14.80	5.90	5.90

RESULTS AND DISCUSSIONS

The following discussion centers upon the effects of reducing the oxygen demand loading from municipal and industrial sources to the Genesee River and the effect of this regulatory activity and other factors on the resulting water quality. These other factors include the effect of nonpoint sources and flow augmentation by the Barge Canal and other tributaries to the Genesee River. Present and projected point source loadings are analyzed in light of average and critical conditions:

1. Average Conditions: Average flow, loadings, and relevent receiving stream conditions as observed during a sampling period beginning July 18, 1973 and ending October 19, 1973.

2. Critical Conditions: The flow considered under this set of conditions involves seven-consecutive-day flow that is expected to recur once in a ten year period, as well as other minimum measured relevent stream conditions.

In the following paragraphs the average conditions will be designated as Case A, and the critical low flow conditions designated as Case B.

The reference line drawn on each calculated dissolved oxygen profile refers to the minimum allowable dissolved oxygen (DO) level permitted under "Classifications and Standards Governing the Quality and Purity of Waters of New York State." The application standard for the portion of the Genesee River in this study reads "Dissolved Oxygen shall not be less than 5.0 mg/l for non-trout waters in streams . . . except that it may be between 4.0 and 5.0 mg/l for short periods of time within any 24 hour period provided the water quality is favorable in all other respects."(6) The paragraphs which follow discuss the present conditions of the Genesee River and projections necessary to assess future requirements for meeting required dissolved oxygen levels in the River.

CASE IA - AVERAGE FLOW CONDITIONS - PRESENT LOADINGS

Figure 36 shows the dissolved oxygen profile of the Genesee River when present loadings and average flow conditions are applied (Case IA). In Case IA the dissolved oxygen levels would be sufficient to meet the Stream Standards at all points in the River, ranging from a

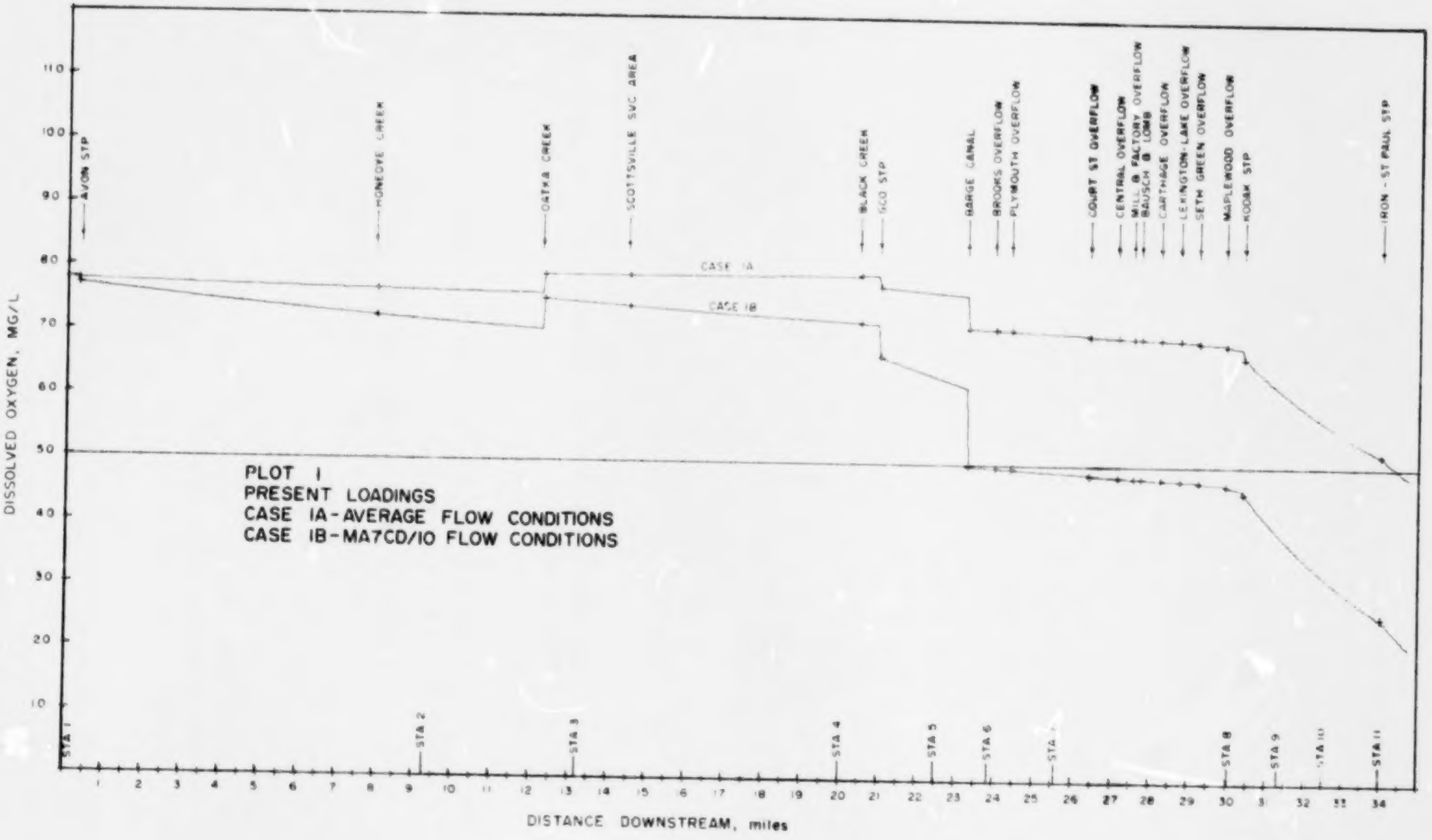

Figure 36. DO Sag Curve-Present Conditions and MA7CD/10 YR Conditions

maximum value of 7.80 mg/l at Avon to approximately 5.0 mg/l at the mouth of the River at Lake Ontario. Four major point source inputs are chiefly responsible for the DO fluctuations under average conditions. These are Oatka Creek, Gates-Chili-Ogden Sewage Treatment Plant, Barge Canal, and the Kodak Wastewater Treatment Plant.

The dissolved oxygen level at the confluence of Oatka Creek and the Genesee River is increased because of the high DO waters of Oatka Creek, under normal conditions. It is interesting to note that the DO profile appears to be better represented by a straight-line rather than an exponential function in the reach from Avon to Oatka Creek. This could be explained by the fact that the reaeration coefficient in this reach is sufficiently high to balance the rate of oxygen utilization. Another contributing factor may well be that nonpoint source contributions override point source contributions in this stretch of the receiving stream.

The average velocity of the Genesee River is approximately 8.2 miles/day from Avon to Honeoye Creek and 7.35 miles/day from Honeoye Creek to Oatka Creek; the total travel time to Oatka Creek is about 1.56 days over a length of 14.5 miles. This does not provide enough time for the River DO to fully recover from the loadings at Avon. Thus the D.O. profile follows a straight-line function in consumption of dissolved oxygen.

In the reach from Oatka Creek to the Gates-Chili-Ogden Sewage Treatment Plant discharge (GCO STP), the Genesee River does tend to recover slightly despite a loading applied at the New York State Thruway Scottsville Service Area. At the Scottsville Service Area, effluent from a 30,000 gpd extended aeration facility is discharged directly to the Genesee. Despite the fact that the total oxygen demand is very high (175.00 mg/l), the effect on the Genesee is minimal since the flow is only on the order of 10,000 gpd. Upon mixing, the effect of the loading is negligible.

At the point where Black Creek enters the Genesee River, the DO is raised from a value of 7.93 mg/l at Oatka Creek to a value of 7.96 mg/l. Since the DO of Black Creek is 8.00 mg/l, the net effective change in DO is again minimized upon mixing with the Genesee River water. The total flow of the Genesee River is increased by 15.0 mgd with the addition of the Black Creek.

At mile point 13.7 from the mouth of the Genesee River, a discharge from the Gates-Chili-Ogden Sewage Treatment Plant enters the Genesee River at a flow of 11.9 MGD. The carbonaceous and nitrogeneous components of ultimate oxygen demand characteristic of this discharge exert a significant influence on the water quality of the Genesee River. The total ultimate oxygen demand measured in the River is increased from a value of 4.51 mg/l before mixing to a value of 10.94 mg/l after mixing. The CBOD is increased from 2.61 mg/l to 5.81 mg/l and the NOD from 1.90 to 5.14 mg/l. The DO of the effluent from GCO is estimated at 4.0 mg/l causing a reduction in DO after mixing with River water of 0.19 mg/l.

From the Gates-Chili-Ogden discharge to the Barge Canal, a steady depletion of DO occurs and a total drop in DO of 0.11 mg/l results in this stretch of the River. A corresponding reduction in oxygen demand of 0.12 mg/l for CBOD and 0.10 mg/l for NOD also occurs. The travel time for this reach is only 0.3 days and a large reduction in oxygen demand not anticipated for such a short time interval.

At mile point 11.4, the New York State Barge Canal crosses the Genesee River. During the warmer months (April to November) the Canal is used for navigational purposes and locks on either side of the canal are used to regulate flow in the canal. Rochester Gas and Electric is authorized to divert up to 375 cfs per day from the Canal to the Genesee River depending on the use of the Canal for navigational purposes. In most instances, however, the full allocation of 375 cfs is diverted, thus increasing the Genesee River flow by 242 MGD. The DO of the Canal water is not as high as one might expect. As the Canal flows east from Lake Erie, it picks up considerable organic and nitrogeneous material by either direct discharges of treated and untreated sewage as well as rural and urban wet weather runoff. Under average conditions, the Canal is slow and sluggish with the degree of reaeration largely dependent upon the activity of navigational traffic. Under such conditions, it is not surprising that the average DO of the Canal is about 6.6 mg/l.

When the Canal water enters the Genesee River it tends to flow downstream rather than cross to the east side of the Canal. Thus, it may be assumed that it mixes completely with river water. Studies conducted by NYSDEC (John Pulaski) show that this is not always the case with many other factors influencing the flow of Canal water. However, for this report it is assumed that the Canal water mixes completely with River water.

After the point of mixing, the DO of the River declines from a premix value of 7.67 mg/l to 7.16 mg/l. This decrease of 0.51 mg/l of DO represents the largest point source initiated depression of DO in the study area. The resultant CBOD and NOD loadings are affected as follows: CBOD increases from 5.69 mg/l to 5.70 mg/l, and NOD decreases from 5.04 mg/l to 4.20 mg/l, reducing the total in-stream oxygen demand (TOD) from 10.74 mg/l to 9.90 mg/l.

Between the Barge Canal and Kodak Sewage Treatment Plant, the River undergoes a decrease in elevation of some 267 feet via a series of falls. Despite the apparent natural reaeration created by the flow of water over the falls, the DO is not significantly increased prior to the point of discharge by Eastman Kodak. This lack of significant reaeration may be due to the influence of the Rochester Combined Sewer Overflows in the City of Rochester. During dry weather periods, three major overflows discharge to the Genesee without any prior treatment. The total dry weather overflow at these overflow points is estimated at 7 MGD, and consists mainly of sanitary sewage at a DO of 2.0 mg/l. The three dry weather overflows are located at Court Street, Seth Green, and Maplewood Avenue. Their immediate effect on the River DO after mixing is minimal. However, measured River levels of CBOD and NOD are increased significantly. The ultimate biochemical oxygen demand at Court Street increases from 9.64 mg/l to 9.81 mg/l; at Seth Green from 9.61 to 10.35 mg/l; and at Maplewood from 10.29 to 11.95 mg/l. These increased loadings override the River's recovery of DO despite the falls within the reach.

At mile point 4.30, Eastman Kodak operates a sewage treatment plant which discharges 28 MGD to the Genesee River. A drastic increase in the measured CBOD and NOD concentrations occurs upon mixing the Kodak treatment plant effluent with the Genesee River. The CBOD increases from 7.69 to 9.10 mg/l while the NOD increases from 4.21 to 6.89 mg /l, and the Total Ultimate Oxygen Demand increases from 11.90 to 16.00 mg/l, the latter representing a 34% increase in loading. An immediate DO reduction also occurs with a drop in DO of 0.19 mg/l from 6.88 to 6.69 mg/l. The Kodak Sewage Treatment Plant discharge exerts a significant influence on the Genesee River in the lower reaches.

In the last two reaches of the Genesee River between the Kodak discharge and the mouth at Lake Ontario, a significant oxygen demand is exerted on the overlying waters of the River by organic and nitrogeneous material that has accumulated in the form of benthic deposits on the River bottom. Calculations have shown the benthic demand to be approximately 0.75 mg/l per square mile of River bottom, or when expressed in more conventional terms, about 0.39-0.65 g/day/m^2. This value was found to be consistent with benthic demand values determined in other studies(78-80). It may be that the slightly lower value determined in this study reflects the dredging activity of the U.S. Army Corps of Engineers and/or dispersion effects. Visual observation during the sampling program indicated a significant benthic demand since gas bubbles were seen to be rising to the surface of the water. The combination of Kodak discharge, benthic demand, and dispersion effects results in a significant DO depletion in the reaches below the falls. The DO decreases from a value of 6.69 mg/l just prior to the Kodak discharge to a value of 5.18 mg/l at the Stutson Street Bridge, mile point 0.7. At this location the total ultimate biochemical oxygen demand has decreased to 12.12 mg/l with individual CBOD and NOD components of 6.51 and 4.99 mg/l, respectively. The total benthic demand alone has caused an oxygen depletion of 0.62 mg/l across this reach.

Analysis of the dissolved oxygen concentrations determined by modeling the stream assimilation capacity indicates that under average flow conditions the DO levels will not be contravened in any section of the River. The DO remains above 5.0 mg/l at all locations. Four point-source discharges cause the major depressions of dissolved oxygen. The discharges determined to have a significant impact are: Oatka Creek, Gates-Chili-Ogden Sewage Treatment Plant, Barge Canal, and the Eastman Kodak Wastewater Treatment Plant. The benthic demand is the most significant nonpoint source factor affecting DO levels in the lower reaches of the Genesee River.

CASE IB - MA7CD/10 CONDITIONS - PRESENT LOADINGS

Figure 36 shows the dissolved oxygen profile of the Genesee River under present average loadings and minimum average seven consecutive day flows that are expected to recur once in a ten year period (MA7 CD/10). The shape of the DO profile is very similar to the profile plotted under average flow conditions except that the immediate resulting dissolved oxygen deficits are much more pronounced following the introduction of the point-source discharges. Under the minimum flow conditions the slope of the DO profile is also considerably greater between point-source discharges.

Although the level of the point-source ultimate biochemical oxygen demand loads are the same under both the MA7CD/10 conditions and average flow conditions, their effect on the River is intensified because of the reduced River flow volumes. Under minimum flow conditions, the DO values at mix points are reduced and the concentrations of oxygen demanding species increased, resulting in more oxygen-demanding material available per unit volume. The critical inputs for DO fluctuations are 1) Oatka Creek, 2) Gates-Chili-Ogden Sewage Treatment Plant, 3) Kodak Wastewater Treatment Plant and, 4) Barge Canal. The immediate effect of the Eastman Kodak discharge on the level of DO under MA7CD/10 conditions is less significant than under average conditions since the DO of the effluent water is at 4.00 mg/l and thus causes little effect when diluted with River water which is at a DO of 4.66 mg/l. The loading of components initiating an oxygen demand are significant, causing a NOD increase of 3.99 mg/l and a CBOD increase of 1.97 mg/l. The TOD thus increases 34 percent, the same percentage increase in total biochemical oxygen demand as anticipated under average flow conditions. However, the 5.98 mg/l TOD increase under MA7CD/10 flow conditions will produce a more significant effect than the 4.10 mg/l TOD increase discharged under average flow conditions.

The most significant tributary input under MA7CD/10 critical flow conditions is the Barge Canal. Prior to mixing, the DO concentration of the River was 6.22 mg/l. After mixing the Canal component with the River, the River-measured DO concentration drops to a level of 4.98 mg/l. The anticipated 1.24 mg/l decrease in dissolved oxygen results from mixing 74 MGD of River water at a DO of 6.22 mg/l with 242 MGD of Canal water at a DO of 4.60 mg/l. After mixing, the level of dissolved oxygen contravenes stream standards and remains below the minimum value of 5.0 mg/l to the mouth of the River. From the Barge Canal to Kodak, the level of dissolved oxygen contravenes the stream standard of 5.0 mg/l reaching a minimum value of 4.66 mg/l just prior to the Kodak discharge. From Kodak to the mouth, the DO level drops rapidly and reaches a value of 2.66 mg/l at Stutson Street Bridge. This latter sharp decline is due to benthic contributions, estuarine contributions and the Eastman Kodak discharge.

In summary, the DO profile follows much the same pattern at MA7CD/10 conditions as at average flow conditions. However, discharge of sewage treatment plant effluent at Gates-Chili-Ogden and the influence of the Barge Canal greatly reduces the DO levels of downstream locations. From a point just subsequent to the Barge Canal, the DO levels are in violation of the minimum allowable DO level of 5.0 mg/l as established by stream standards.

CASE II - BEST PRACTICAL CONTROL TECHNOLOGY CURRENTLY AVAILABLE (BPCTCA) UNDER AVERAGE FLOW CONDITIONS AND MA7CD/10 CONDITIONS

The dissolved oxygen profile of the Genesee River as depicted on Figure 37 is that which is projected upon implementation of best practical control technology currently available to industrial waste treatment and secondary treatment to municipal discharges. For industrial discharges within the study area, the application of BPCTCA will result in an ultimate biochemical oxygen demand loading that will be essentially the same as that currently being discharged. The figures used in this analysis are those determined by the Permits Branch of the U.S. Environmental Protection Agency, Region II. For municipal discharge the application of secondary treatment should result in 85 percent removal of TOD.

By comparing the DO profile of present loadings (Case IA) with the loadings anticipated upon application of BPCTCA (Case IIA), it can be seen that very little improvement in the level of DO can be expected when compared to present conditions. The dissolved oxygen level in the River between Avon and the Kodak Wastewater Treatment Plant discharge would be predicted to increase by 0.13 mg/l assuming average river flow. At Stutson Street Bridge the DO is increased 0.24 mg/l. In both instances, the DO is maintained above a level of 5.0 mg/l as required by stream standards. The results are essentially the same under MA7CD/10 low flow conditions for Case IIB as compared to Case IB.

In this study, initial input to the model for BPCTCA conditions utilized existing municipal treatment plant discharge flow volumes as opposed to utilizing treatment plant design flows. Realizing that the effect on the river of treatment plant discharges might be greater under design flows, a plot of the DO sag curves was generated by inputting both present flow volumes and design flow volumes to the model and comparing the output. As can be seen in Figure 38 the DO profiles for each case under MA7CD/10 year conditions shows the DO to be reduced as much as 0.3 mg/l in the upper reaches under design flows as opposed to present flows. This decrease in DO upstream of the Barge Canal is not critical since the DO is well above the minimum requirement for Class B streams of 5.0 mg/l. At the confluence of the Barge Canal and the river, the flow from the canal is nearly 75 per cent of the total river flow under MA7CD/10 year flow conditions. This large volume contributed by the Canal tends to minimize the effects of increasing the discharge flows of municipal plants to design capacities. This can be expected to be the case for any future expansions of these plants as well.

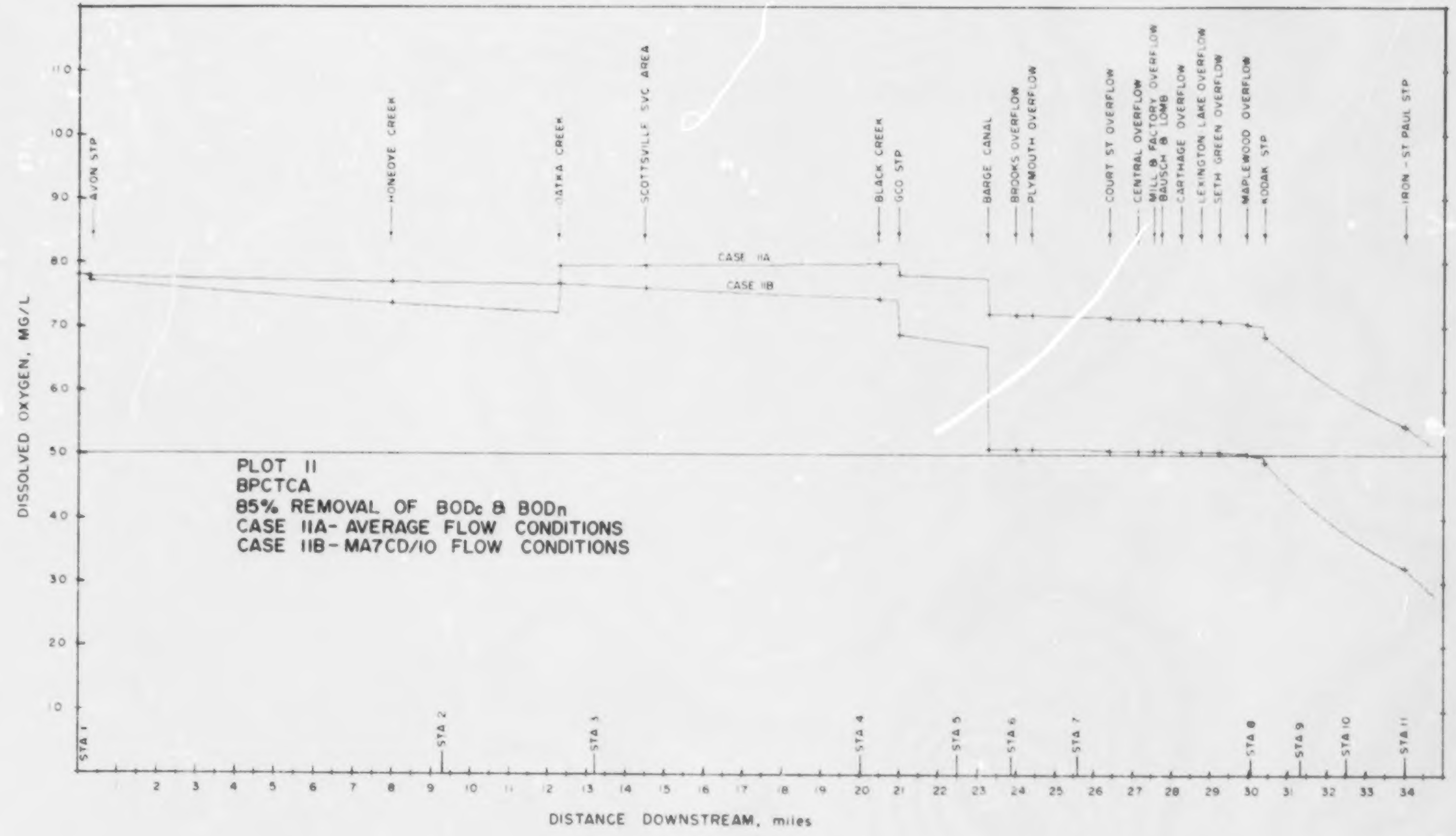

Figure 37. DO Sag Curve - BPCTCA Conditions

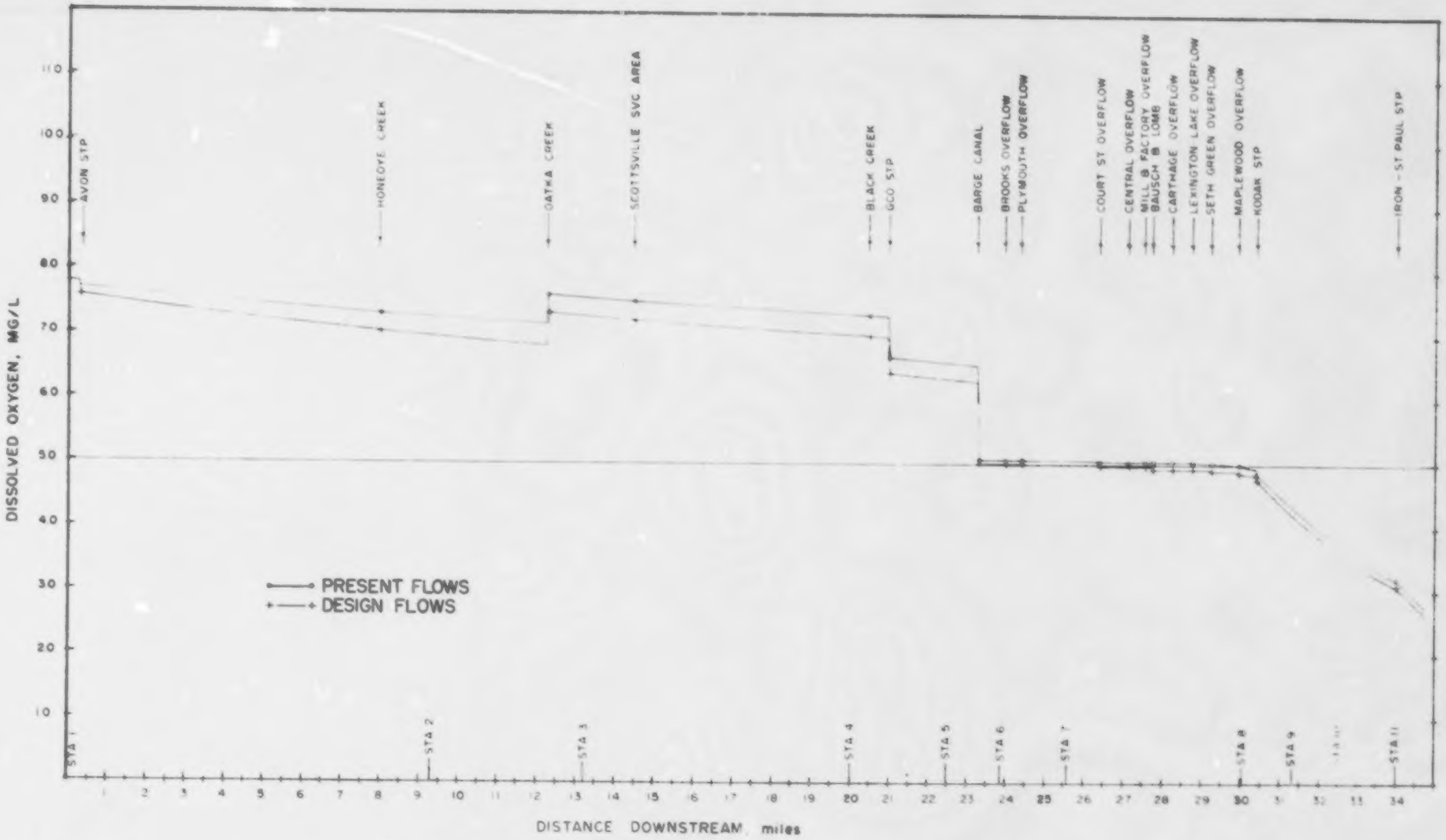

Figure 38. BPCTCA under MA7CD/10YR Conditions – Present vs. Design Flows of Treatment Plants

CASE III - EIGHTY-FIVE PERCENT REMOVAL OF CBOD AND NOD FOR MUNICIPAL DISCHARGES

The dissolved oxygen profile for this case is depicted on Figure 39 under both average (Case IIIA) and MA7CD/10 flow conditions (Case IIIB). A comparison of the dissolved oxygen profiles developed under Cases I and II show no significant increase in DO levels as a result of 85% removal of oxygen demanding constituents in municipal effluents. At the Eastman Kodak Sewage Treatment Plant, the DO level would be raised from 6.88 mg/l to 7.07 mg/l for a DO increase of 0.19 mg/l. At the Stutson Street Bridge location, the DO level is raised from 5.22 mg/l to 5.59 mg/l for an increase of 0.37 mg/l. The major effect of providing 85% treatment for the removal of oxygen demanding constituents from upstream municipal plants is to cause the DO level downstream of Kodak to be raised more significantly than at other upstream locations. This effect is most desirable since the River downstream of Kodak is the area most likely to have DO conditions which contravene stream standards.

CASE IV - NINETY PERCENT REMOVAL OF CBOD AND NOD FOR MUNICIPAL DISCHARGES

The dissolved oxygen profile for this case is depicted as Figure 40 under both average (Case IVA) and MA7CD/10 flow conditions (Case IVB). Comparison of Case IVA with Case IIIA, indicates little DO related water quality improvement is attained by increasing the removal rates from 85 to 90 percent. For example, the total increase in DO at Stutson St. Bridge attained by increasing the degree of municipal treatment from 85 to 90 per cent is only 0.03 mg/l.

Comparison of cases IVA and IA, shows that some improvement in dissolved oxygen is anticipated with the most significant effect occurring downstream of the Gates-Chili-Ogden treatment plant discharge where an increase in DO of 0.13 mg/l is predicted just prior to confluence of the River and the Barge Canal. Improvement in dissolved oxygen is also expected downstream of the Barge Canal where the DO is predicted to increase 0.22 mg/l as a result of reduced loading of residual organic and nitrogeneous components in the GCO discharge. At Stutson Street Bridge the DO increase between present conditions and the case of 90% removal is 0.40 mg/l, this being largely the result of decreased loading of oxygen demanding components at upstream municipal plants.

Comparison of calculations for Cases IVB and IIIB under MA7CD/10 flow conditions show a slight improvement in DO when comparing 90% and 85% removal of CBOD and NOD at River locations prior to the Barge Canal. Just prior to the point of intrusion of the Barge Canal waters, the DO of the River increases from a value of 6.57 mg/l for the 85% removal case to a value of 6.68 mg/l for the 90% removal case. Upon mixing with the Canal waters, the DO increases from a value of 5.06 mg/l predicted for the 85% removal to a value of 5.09 mg/l for the case of 90% removal. The effect of the large contribution of flow volume from the Canal is evident: under MA7CD/10 flow an improvement in River water quality upstream of the Canal is nearly negated by the addition of the Canal water having a low DO reflecting the corresponding low flow. The DO profile for 85 and 90 percent removal of oxygen demand constituents are nearly identical downstream of the Barge Canal with a DO difference between the two degrees of treatment at Stutson Street Bridge being only 0.07 mg/l.

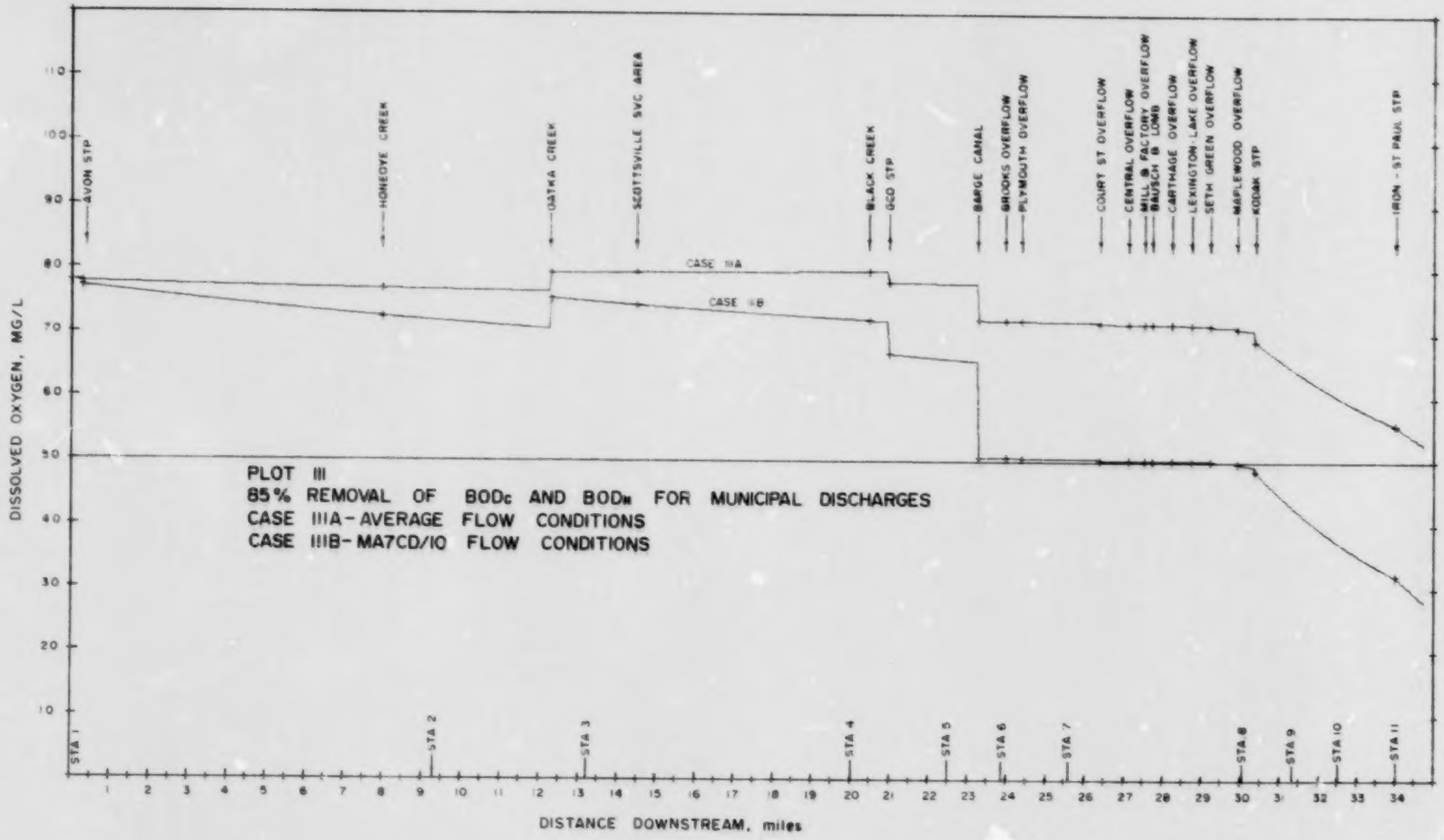

Figure 39. DO Sag Curve for 85% removal of TOD for Municipal Discharges

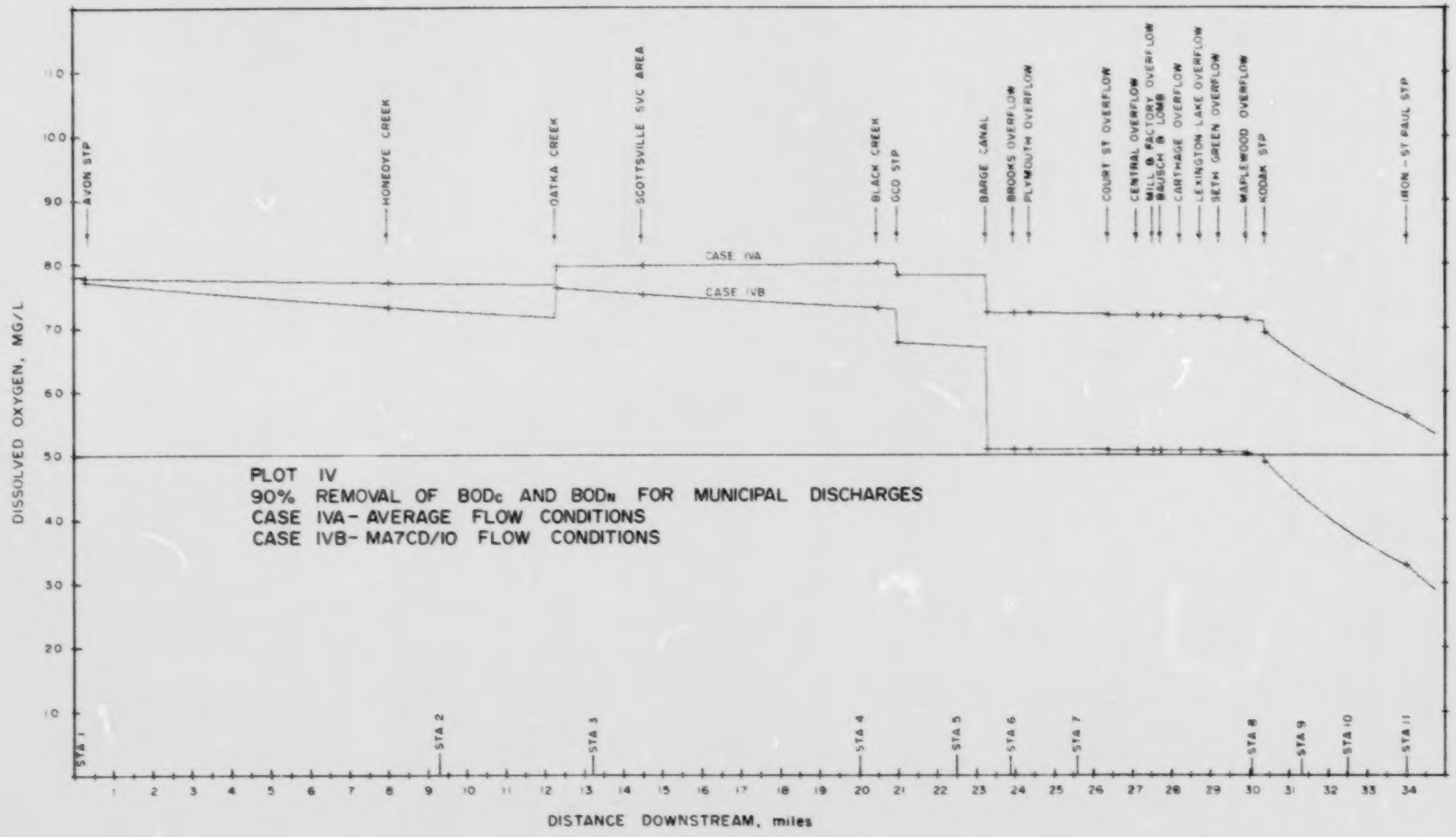

Figure 40. DO Sag Curve for 90% removal of TOD for Municipal Discharges

Comparison of Cases IVB and IB shows increased DO levels predicted at all locations for the 90% municipal treatment over present conditions. Only mild increases in DO are evident from Avon to the Gates-Chili-Ogden Sewage Treatment Plant discharge, for the most part less than 0.1 mg/l. However, by increasing the level of treatment at the GCO plant to 90%, the dissolved oxygen in the reach between GCO and the Barge Canal is increased by 0.46 mg/l just prior to the mixing of the Canal water, a most significant improvement. Because of the large volume of flow added by the Canal, and its corresponding depressed DO, the DO level of the River itself is significantly lowered by addition of the Canal water to the main stem. In the case of 90% removal of CBOD and NOD loading to the Genesee River from municipal discharges, the DO in the River under critical low flow (MA7CD/10) is dropped from a value of 6.68 mg/l to a value of 5.09 mg/l simply by addition of Canal waters. This can be reasoned by noting that 242 MGD of Canal water at a DO of 4.60 mg/l will drastically reduce a DO of 6.68 mg/l within the 75 MGD main stem immediately upstream.

An important result of applying 90% removal of CBOD and NOD to municipal waste treatment plants stems from the fact that the DO levels will remain above the minimum allowable DO levels, 5.0 mg/l, as established by NYSDEC, stream standards in that portion of the River above the Eastman Kodak Wastewater Treatment Plant discharge. Below the Eastman Kodak discharge, the combination of Kodak effluent, benthic demand, and dispersion effects result in a DO that is in contravention of the stream standards. The predicted DO may be as low as 3.28 mg/l under the application of 90% municipal treatment under MA7CD/10 low flow conditions. This compares with a value of 2.64 mg/l projected for existing loadings under the same critical MA7CD/10 flow conditions.

CASE V - NINETY-FIVE PERCENT REMOVAL OF CBOD AND NOD FOR MUNICIPAL DISCHARGES

The dissolved oxygen profiles for Case V for both average flow conditions (Case VA) and MA7CD/10 critical low flow conditions (Case VB) are depicted on Figure 41. Comparison of the plot of Cases VA and IVA shows virtually no improvement in predicted main stem DO levels for 95% removal of CBOD and NOD over those predicted for 90% treatment under average flow conditions. The maximum increase in DO under these flow and treatment constraints is predicted at Stutson Street Bridge where the DO would be anticipated to increase from 5.62 mg/l under 90% treatment of 5.67 mg/l under 95% treatment, for an increase of 0.05 mg/l. At all other locations on the Genesee River, the net projected increase in DO is less than or equal to 0.05 mg/l.

Under MA7CD/10 flow conditions, some improvement in River DO is projected but in no instance does the improvement exceed 0.11 mg/l as anticipated just prior to the point of intrusion of the Barge Canal. However, it should be noted that the projected River DO exceeds the minimum allowable level of 5.0 mg/l at all locations upstream of the Kodak discharge when 95% CBOD and NOD removals are applied.

The dissolved oxygen levels anticipated to be achieved via application of 95% removal of municipal CBOD and NOD loadings show only slight improvement compared to those predicted for 90% removal under average flow conditions. The same comparisons hold true for MA7CD/10 critical low flow conditions. Considering existing loadings under MA7CD/10 low flow conditions, one would project a DO of 2.66 mg/l for the DO at the Stutson Street Bridge as compared to DO's of 3.30 mg/l and 3.37 mg/l projected as a result of applying 90% and 95% CBOD and NOD removal, respectively.

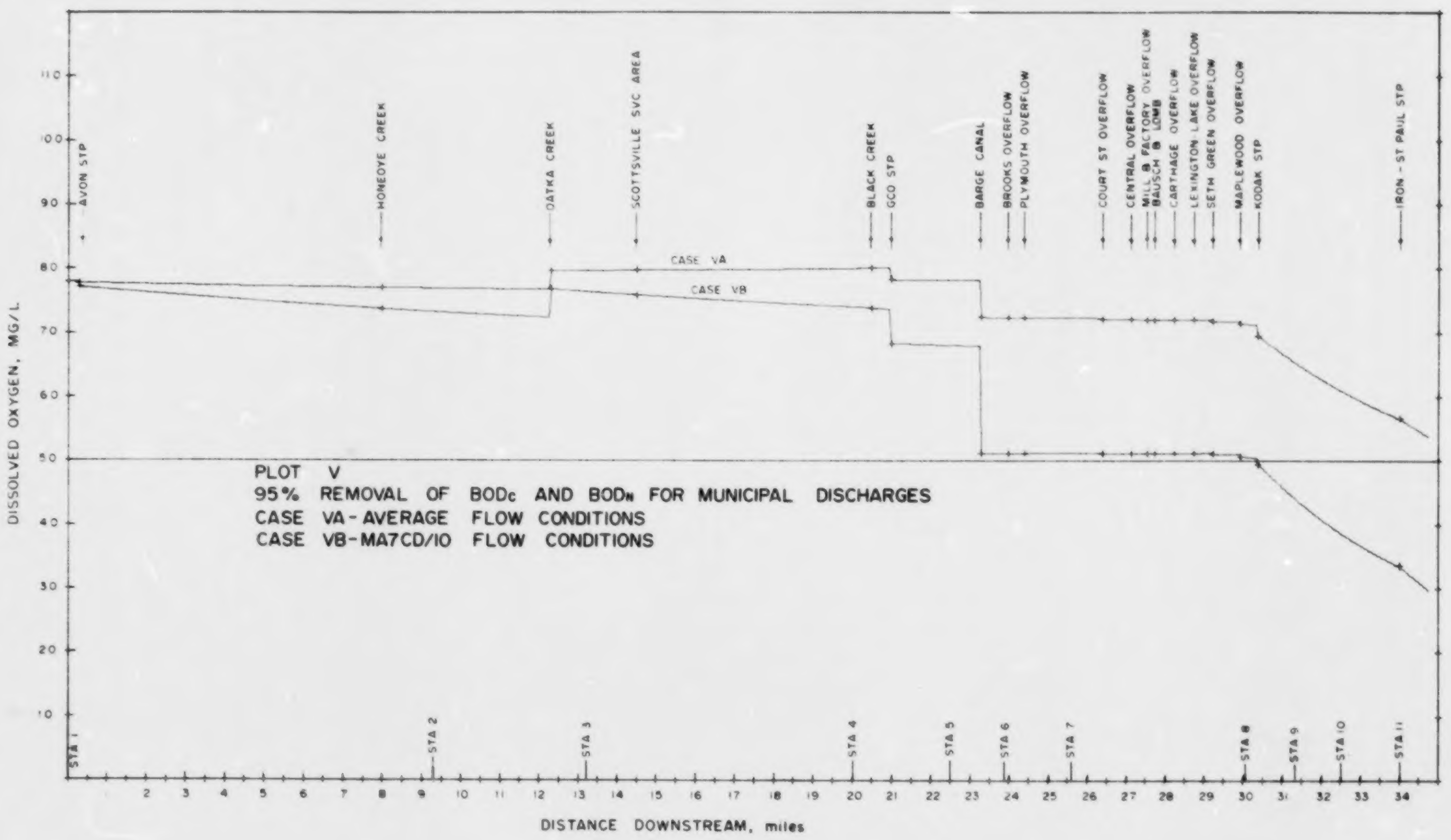

Figure 41. DO Sag Curve for 95% removal of TOD for Municipal Discharges

CASE VI - NINETY-EIGHT PERCENT REMOVAL OF CBOD AND NOD FOR MUNICIPAL DISCHARGES

The dissolved oxygen profiles for 98% removal of CBOD and NOD loading from municipal discharges under average flow (Case VIA) and MA7CD/10 critical flow (Case VIB) conditions are shown on Figure 42. Comparison of Case VIA and Case VA show virtually no improvement in the predicted DO profile. The maximum increase in DO predicted at Stutson Street Bridge when comparing 98% treatment to 95% treatment is equal to 0.03 mg/l. At all other locations on the River, the DO increase is less than the above mentioned value of 0.03 mg/l.

For the similar comparison of 98% vs 95% treatment under MA7CD/10 flow conditions one would project an increase in DO amounting to 0.07 mg/l, in the main stem just prior to the point of intrusion of the Barge Canal. After the point of intrusion of the Barge Canal, the comparison of 98% to 95% removal of CBOD and NOD shows a predicted increase in DO within the receiving stream of only 0.02 mg/l. The implementation of 98% treatment would not result in any significant improvement in the DO of the main stem.

Comparison of Case VI DO profiles to Cases IV and V DO profiles show only slight improvement. At Stutson Street Bridge under critical MA7CD/10 flow conditions, the DO predicted for 90% treatment is 3.30 mg/l; for 95% treatment, 3.37 mg/l; and for 98% treatment, 3.42 mg/l. Under average flow conditions, the main stem DO values predicted for the Stutson Street Bridge location are 5.62 mg/l, 5.67 mg/l, and 5.70 mg/l respectively, for 90%, 95% and 98% treatment application. Just prior to the point of intrusion of the Barge Canal waters, the River DO's are 7.81, 7.83, and 7.84 mg/l for 90%, 95% and 98% treatment, respectively under average flow conditions, and 6.68, 6.79 and 6.85 mg/l, respectively, under MA7CD/10 flow conditions.

CASE VII - NINETY-EIGHT PERCENT REMOVAL OF CBOD AND NOD FOR BOTH MUNICIPAL AND INDUSTRIAL DISCHARGES

The dissolved oxygen profiles projected for this case under both average (Case VIIA) and MA7CD/10 flow conditions (Case VIIB) are depicted on Figure 43. The main stem dissolved oxygen profiles projected for 98% CBOD and NOD treatment of all municipal and industrial discharges have been shown to be nearly identical to the DO profiles projected for Cases VIA and VIB in the stretch of River from Avon to just above the Kodak Sewage Treatment Plant. However, from the Eastman Kodak Treatment Plant discharge to the mouth of the Genesee, the projected DO levels were significantly increased by applying 98% treatment of the Kodak discharge. Just prior to the point of intrusion of the Eastman Kodak discharge, the DO is 6.95 mg/l under average flow conditions. This compares with a DO of 6.08 mg/l projected at the Stutson Street Bridge. Under MA7CD/10 low flow conditions the projected DO prior to the point of intrusion of the plant discharge is 4.97 mg/l and gradually drops off to a value of 4.17 mg/l at Stutson Street Bridge. A difference of 0.38 mg/l and 0.75 mg/l in projected DO under average and MA7CD/10 flow conditions, respectively, is determined to result solely from the application of 98% treatment of CBOD and NOD to the Eastman Kodak Wastewater Treatment Plant discharge. This is arrived at by comparing Cases VIA and VIB with Case VIIA and VIIB, that is, 98% treatment of municipal discharges and 98% treatment of both municipal and industrial discharges.

Comparing Cases VII A & B (98% treatment of municipal and industrial discharges) with Cases IA & B (present loadings), a marked increase is observed in DO in the section of the

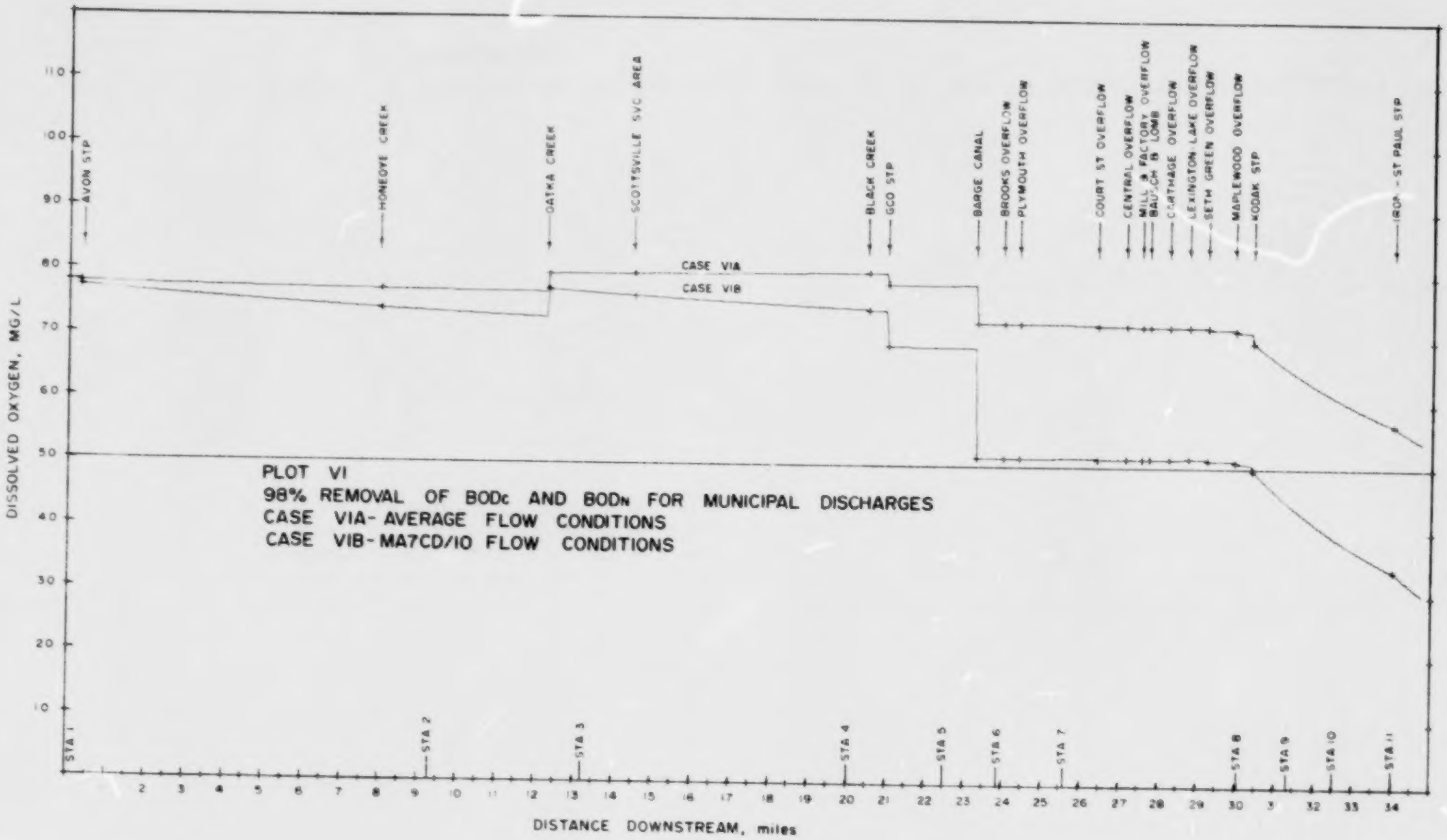

Figure 42. DO Sag Curve for 98% removal of TOD for Municipal Discharges

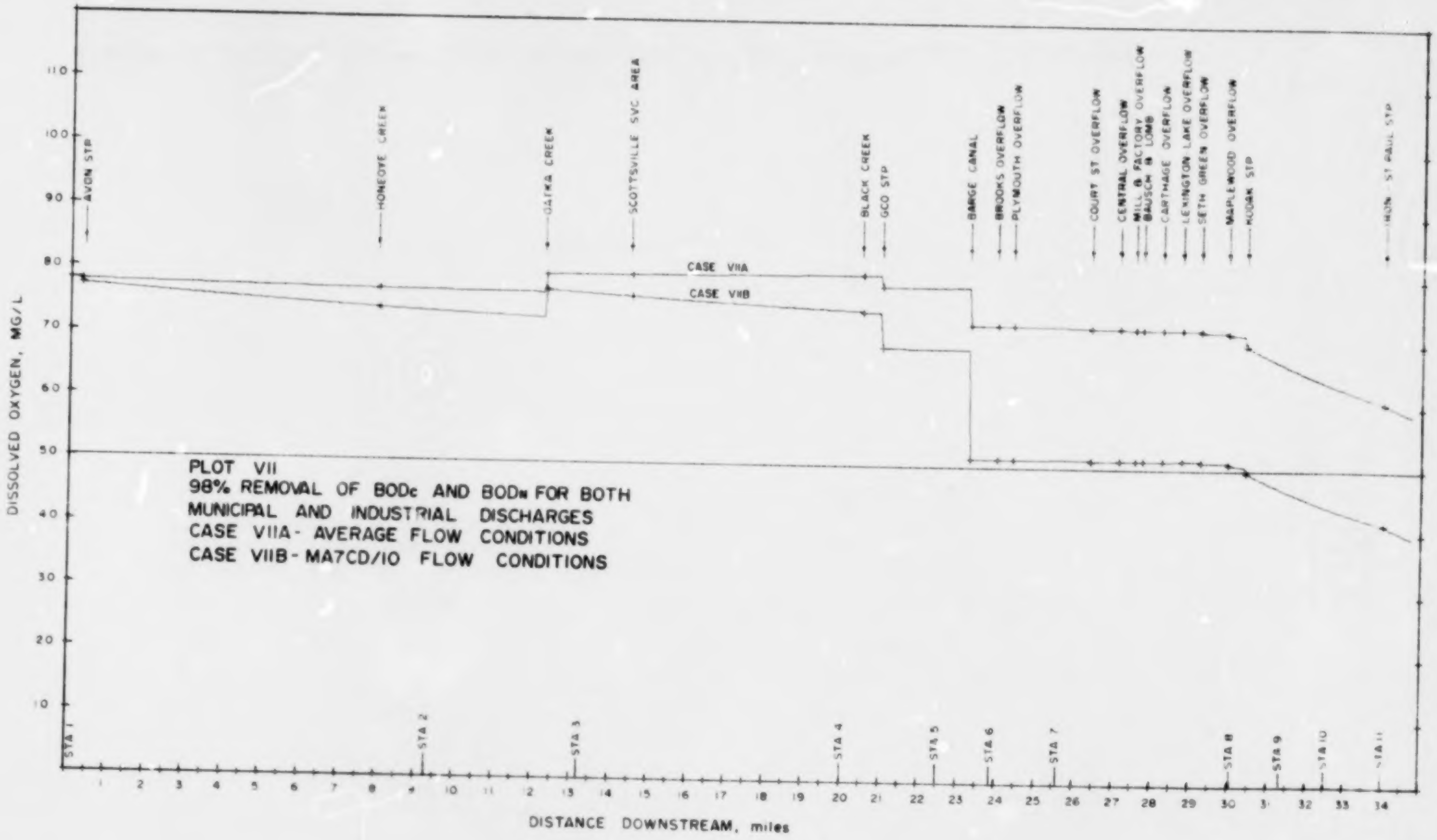

Figure 43. DO Sag Curve for 98% removal of TOD for Municipal and Industrial Discharges

River downstream of the Eastman Kodak treatment plant discharge. At Stutson Street Bridge, the DO is projected to be improved by 0.86 mg/l under average flow conditions and 1.51 mg/l at MA7CD/10 flow conditions. Under average flow conditions the projected increase in DO at other River locations varies from 0.06 mg/l at the GCO discharge to 0.33 mg/l at Oatka Creek with application of 98% treatment of both municipal and industrial discharges. For MA7CD/10 flow conditions the DO increases at River locations upstream of the Kodak discharge vary from 0.17 mg/l at Oatka Creek to 0.64 mg/l just prior to entry of the Barge Canal waters.

By applying 98% treatment practices to all municipal and industrial discharges to the Genesee River, the stream standard of 5.0 mg/l DO would be met at all locations under average flow conditions. Under MA7CD/10 flow conditions, the DO level of the critical lower reaches of the river would be raised to within slightly less than 1.0 mg/l of the minimum allowable DO as determined by the NYSDEC stream standards.

OTHER FACTORS AFFECTING DISSOLVED OXYGEN LEVELS IN THE GENESEE RIVER

In analyzing Figures 39 through 43 the dissolved oxygen profiles have demonstrated the significant influence of the Kodak Sewage Treatment Plant, benthic demand, and the dispersion effects on the water quality anticipated in the lower section of the Genesee River. The stretch of major influence begins at a point before the Kodak discharge and extends to the mouth. The effect of each of the three major contributing factors is now discussed in greater detail so that effective steps may be considered which would improve the level of dissolved oxygen within the receiving stream:

Case VII: Effect of Barge Canal on Genesee River

Case IX: Effect of Kodak Discharge on Genesee River

Case X: Effect of Dispersion Coefficient on Genesee River

Case XI: Effect of Benthic Demand Rates on Genesee River

CASE VIII. EFFECT OF BARGE CANAL ON GENESEE RIVER

It has been pointed out in other sections of this report that the New York State Barge Canal exerts a considerable influence on the level of dissolved oxygen projected in the Genesee River. This sub-section will attempt to develop how significant that influence is.

With all other point source contributions of ultimate oxygen demanding constituents held constant, the assimilation capacity model was run with the dissolved oxygen concentration of the Barge Canal varied in increments from 3.6 to 8.6 mg/l. Note that all other conditions were held constant with the concentration of dissolved oxygen, the only variable. The results are depicted on Figures 44 and 45 in the form of Plots VIIIA and VIIIB, average flow conditions and MA7CD/10 conditions, respectively. As can be seen on Plot VIIIA, after mixing the River DO varied from a high of 8.11 mg/l to a low of 5.73 mg/l for DO values of the canal at 8.6 and 3.6 mg/l, respectively. The impact of the Canal DO at downstream stations can also be determined from Plot VIIIA.

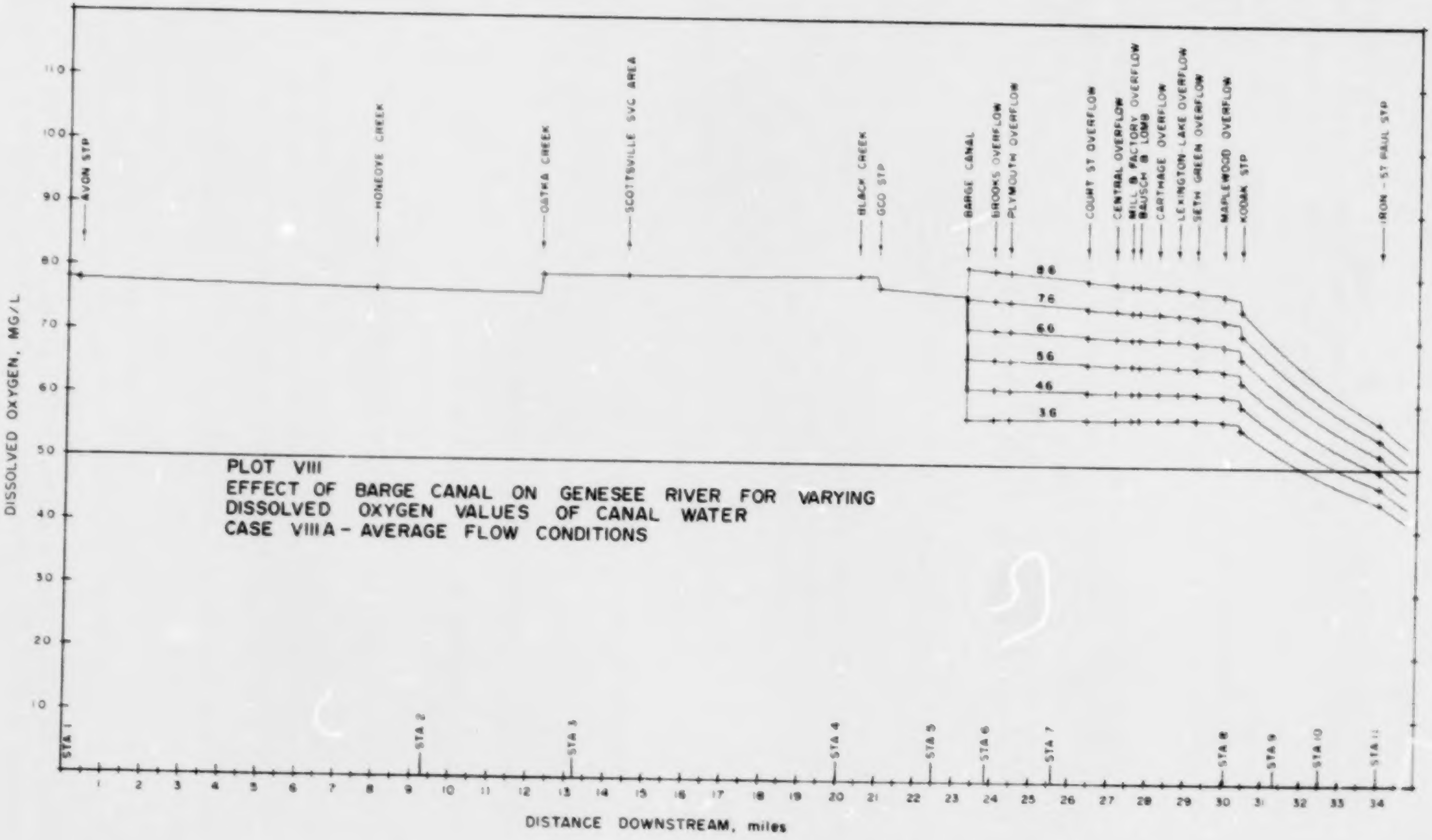

Figure 44. Effect of Barge Canal DO on Genesee River DO- Average Flow Conditions

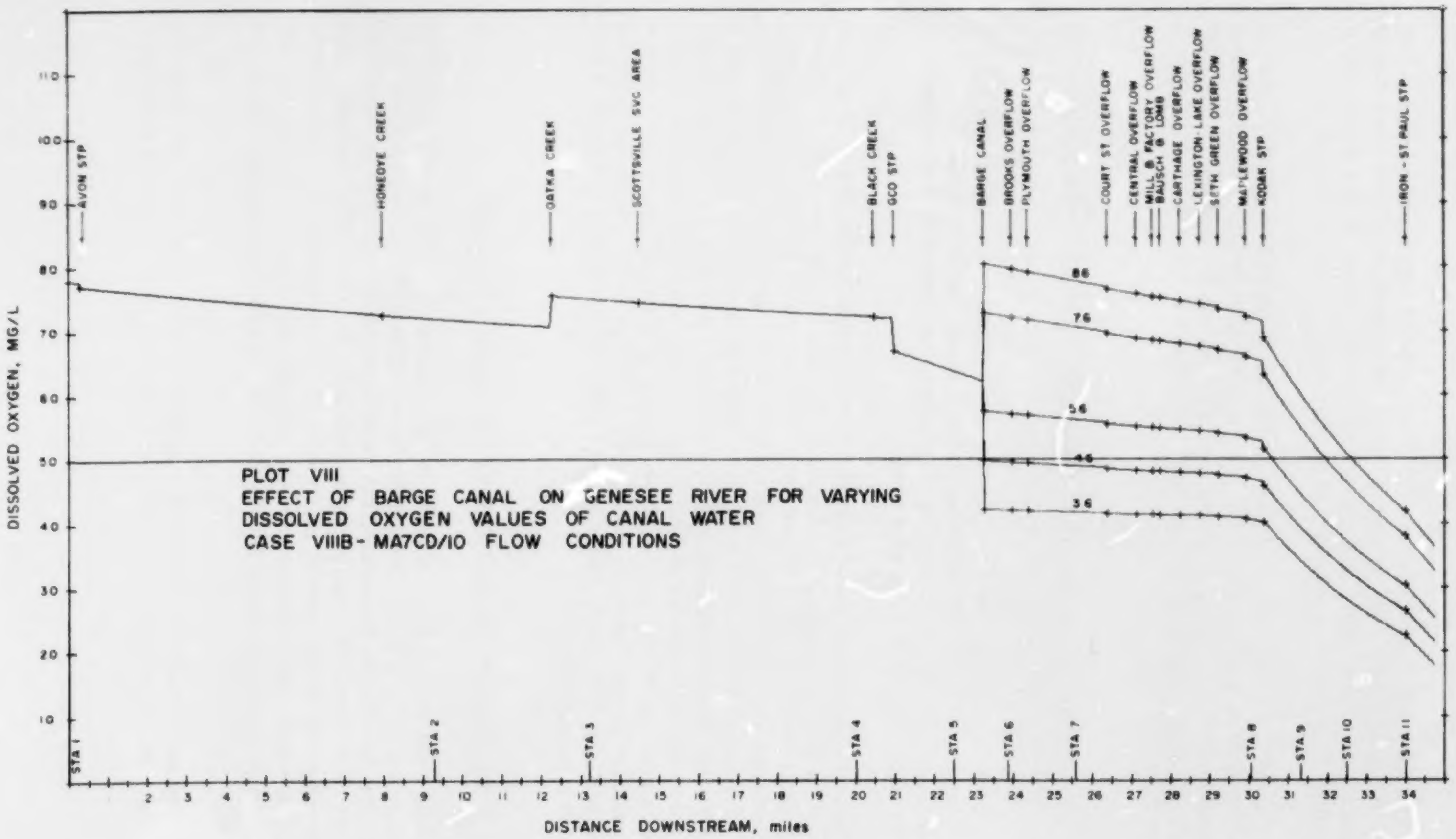

Figure 45. Effect of Barge Canal DO on Genesee River DO-MA7CD/10YR Conditions

At the Kodak Wastewater Treatment Plant, the impact of mixing the treated process wastewater with the River water becomes less significant as the ratio of the respective DO's increases. At the Stutson Street Bridge, the projected DO ranges from 5.68 to 4.43 mg/l as [illegible]

It can be concluded that the DO concentration and flow of the Barge Canal plays a major role in determining whether the dissolved oxygen levels in that portion of the river below Kodak contravene stream standards. Maintaining the DO concentration of the Barge Canal above 6.6 mg/l will insure that stream standards can be achieved.

Under MA7CD/10 conditions as depicted on Figure 45, it can be seen that the DO level of the Canal water must be kept at a value above 8.6 mg/l to meet the stream standards. Since this is a difficult requirement to meet, it would perhaps be more practical to consider decreasing the effect of benthic demand in the lower reaches of the Genesee River as a more effective control strategy.

CASE IX. EFFECT OF KODAK WASTEWATER TREATMENT PLANT DISCHARGE ON THE GENESEE RIVER

With regard to the Eastman Kodak process wastewater treatment plant discharge, the Stream Assimilation Capacity Model was applied, under variable loadings from the Kodak plant with all other loadings and flows set equal to the average encountered during the field sampling program. The result are plotted on Figure 46.

The comparison of present discharged quantities with results projected for the no discharge condition showed a considerable increase in dissolved oxygen in the pre-defined critical stretch. After mixing the present Kodak effluent load with the River waters, an immediate reduction of DO occurs, the decrease being from 6.88 to 6.69 mg/l. The DO profile then continues to decline to a value of 5.18 mg/l at Stutson Street Bridge. When the discharge of ultimate oxygen demanding constituents ceases, no immediate reduction of DO occurs and the DO profile improves, with the projected DO at the Stutson Street Bridge increasing to 5.78 mg/l, an improvement of 0.60 mg/l. The projected isolated effect of the present ultimate oxygen demanding constituents of the Kodak discharge is to lower the dissolved oxygen in the lower reach by 0.60 mg/l. This does not include the dispersion effects which would only aggravate this projection.

CASE X. EFFECT OF DISPERSION COEFFICIENT ON GENESEE RIVER

The third factor influencing the critical stretch of the Genesee River is the effect of dispersion, and is subsequently examined. In attempting to determine the isolated influence of the estuarine inducted horizontal dispersion, the benthic demand was held constant and value of the dispersion coefficient "E" varied from E=0.0001 to E = 1000.0 mi^2/day. This approach allowed the response of the model to changes in the dispersion coefficient to be delineated. Some of the results were plotted and are depicted on Figure 47. Table 21 lists the dissolved oxygen values projected from the various "E" coefficients applied for several mile-points in the reach.

Plots XA and XB in Figures 47 and 48 respectively, appear to have a point of discontinuity at mile-point 34.0 when the dispersion coefficient is in the range of 0.0 to 3.0 mi^2/day.

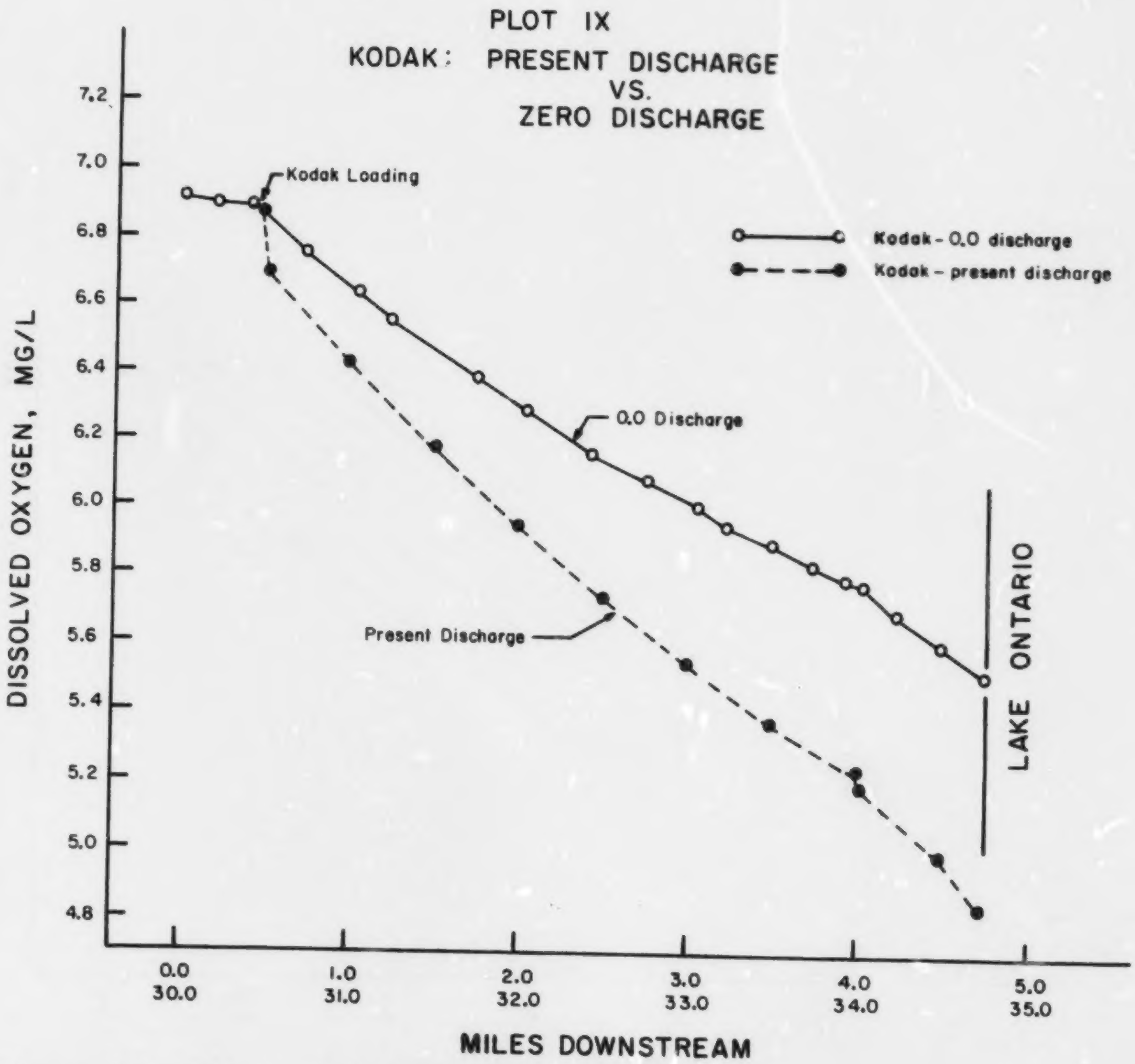

Figure 46. Effect of Kodak on Genesse River

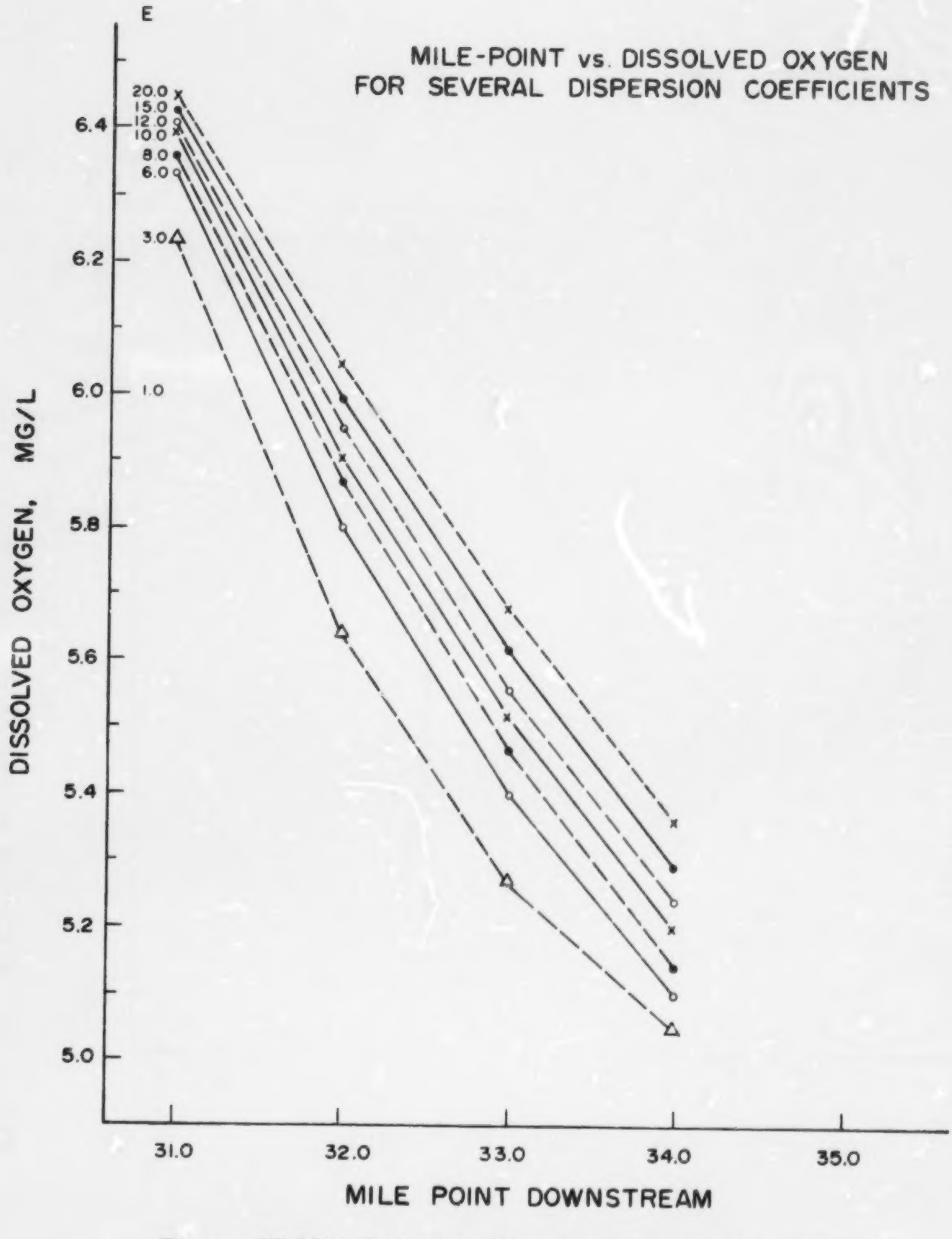

Figure 47 Mile-Point vs. Dissolved Oxygen for several Dispersion Coefficients

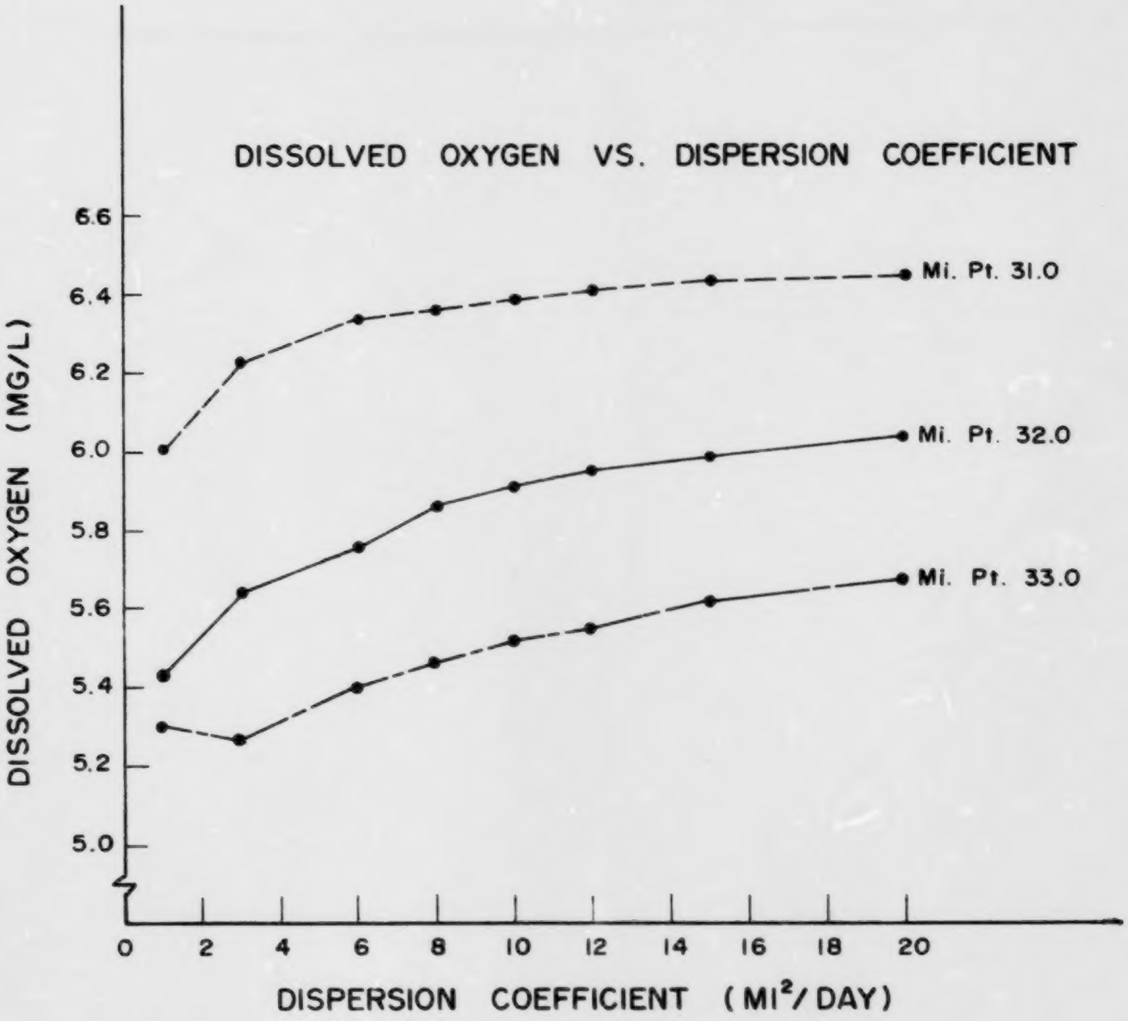

Figure 48 Dissolved Oxygen vs. Dispersion Coefficient

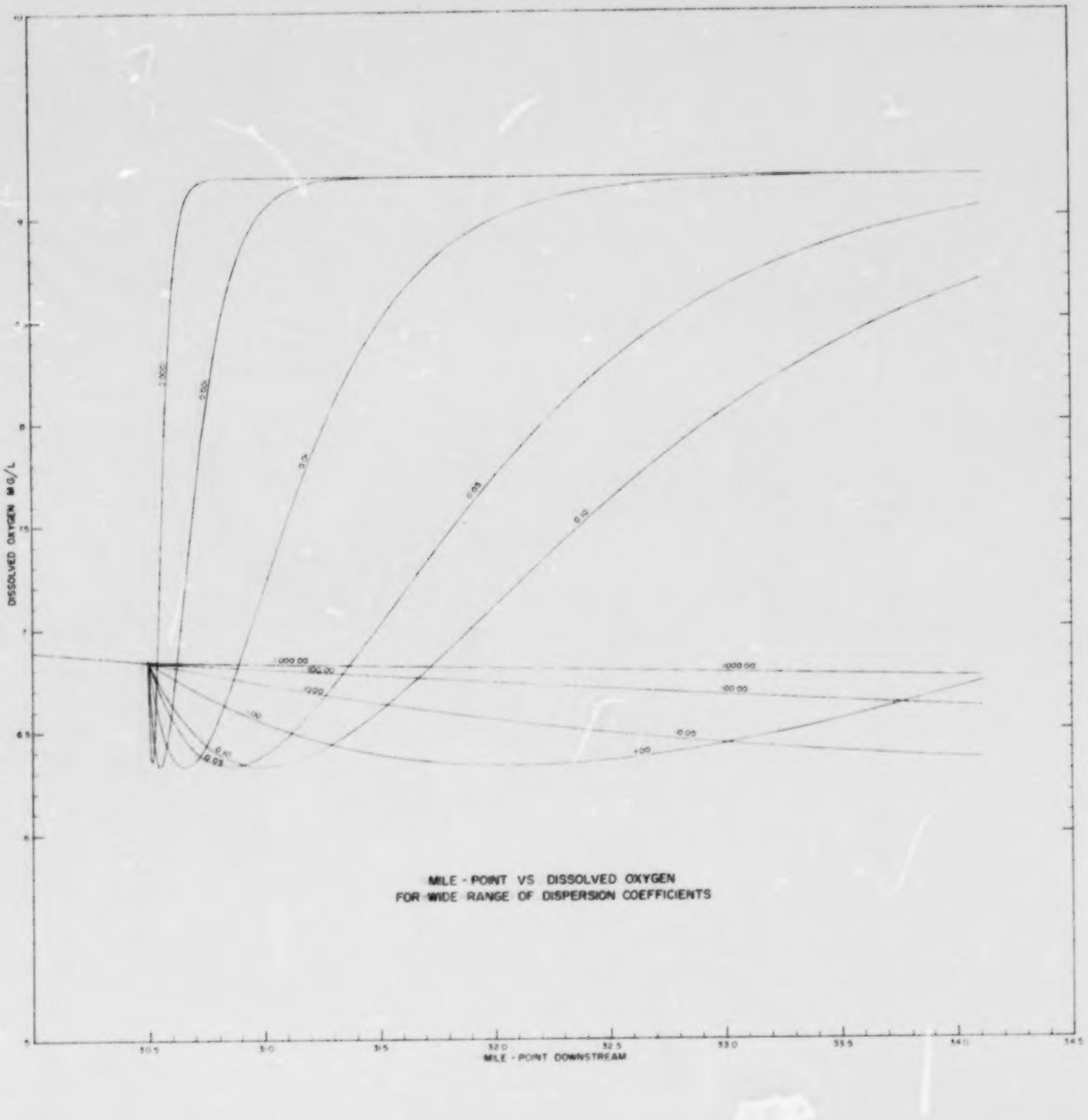

Figure 49 Mile-Point vs. Dissolved Oxygen for 0.0001≤E≤1,000.0

However, examination of Plot XC in Figure 49 shows that the function is not discontinuous in this range. As the E value is allowed to decrease from its calculated value of 10.0 mi^2/day the DO tends to reach its minimum value in a much shorter distance, thus allowing the DO in the river to recover much more quickly as evidenced by the DO profile at which E=0.0001 mi^2/day. As E, the degree of mixing, increases the distance required for the organic matter in the stream to be completely assimilated is also increased. For the special case of E=0.0, the function itself is mathematically discontinuous as can be seen from the stream coefficient equation $j=v\sqrt{K/E}$.

Table 21. Dissolved Oxygen Levels For Several Dispersion Coefficients

Dispersion Coefficient	Mile-Point 31.0	32.0	33.0	34.0
0.0	6.53	6.22	5.91	5.61
1.0	6.01	5.43	5.31	5.39
3.0	6.23	5.64	5.27	5.05
6.0	6.33	5.80	5.40	5.10
8.0	6.36	5.87	5.47	5.15
10.0	6.39	5.91	5.52	5.20
12.0	6.41	5.95	5.56	5.24
15.0	6.43	5.99	5.62	5.29
20.0	6.45	6.05	5.68	5.36

From Figure 47, it can be deduced that values of the dispersion coefficient, "E", in the range of 3.0 - 20.0 mi^2/day, results in a variation of projected values of dissolved oxygen in the range of 0.22 mg/l - 0.41 mg/l in the stretch from mile-points 31.0 to 34.0. For this study a dispersion coefficient of 10.0 mi^2/day had been calculated and applied in the course of developing and applying the Steam Assimilation Capacity Model. Under average stream conditions, a dispersion coefficient of 10.0 mi^2/day well describes the effect of the estuarine influence exerted by Lake Ontario on the Genesee River. A plot of dispersion coefficient as a function of dissolved oxygen as shown in Figure 48 indicates that a constant slope is achieved in applying a range of dispersion coefficients ranging from 3.0 to 20.0 mi^2/day. This indicates a near constant rate of change of dissolved oxygen with a change in dispersion coefficient and that this rate of change involves a positive proportional correlation. This is consistent with the reasoning that when dispersion coefficients are present, one would expect a dilution of river concentrations of oxygen demanding constituents exerting less demand in the receiving stream and corresponding increases in dissolved oxygen.

CASE XI. EFFECT OF BENTHIC DEMAND RATES ON GENESEE RIVER

The influence of the benthic demand was the third factor found to significantly affect oxygen levels predicted in the lower reaches of the Genesee River. The sensitivity of the

Stream Assimilation Capacity Model to changing benthic demands was determined by holding both the Kodak discharge ultimate oxygen demand loading and the dispersion coefficient constant (E = 10.0 mi^2/day). By varying the benthic demand, the sensitivity to this variable could then be determined. Table 22 lists the predicted dissolved oxygen levels resulting from the application of various benthic demand factors for several mile-points within the reach.

Table 22. Dissolved Oxygen Levels for Varying Benthic Demand Rates mg/l

Benthic Demand Rate (mg/l/sq.mi.)	Mile-Point			
	31.0	32.0	33.0	34.0
0.00	6.50	6.20	5.98	5.82
0.18	6.47	6.11	5.84	5.63
0.37	6.43	6.03	5.70	5.45
0.62	6.34	5.91	5.52	5.20

From Figures 50 and 51, it is seen that increasing the benthic demand factor results in a decreased dissolved oxygen content within the lower stretch of the River. A plot of the magnitude of the benthic coefficient versus predicted dissolved oxygen concentration results in a straight-line curve indicating a constant rate of change of dissolved oxygen with an increasing applied benthic demand. The benthic coefficient used in this study was determined to be 0.62 mg/l/mi^2 of river bottom. The net effect of applying this benthic rate as opposed to neglecting any benthic demand is to decrease the predicted dissolved oxygen by nearly 0.62 mg/l in the lower reaches of the Genesee River.

A combination of the ultimate oxygen demand presented by Kodak Sewage Treatment Plant discharge, the dispersion coefficient, and the benthic demand results in a decrease in the predicted dissolved oxygen within the River by 1.63 mg/l. The summation of the effect of these factors has been verified by comparing the predicted decrease in DO under average conditions, 1.63 mg/l, with the average difference of 1.66 mg/l measured in the field between the Eastman Kodak discharge and the Stutson Street Bridge.

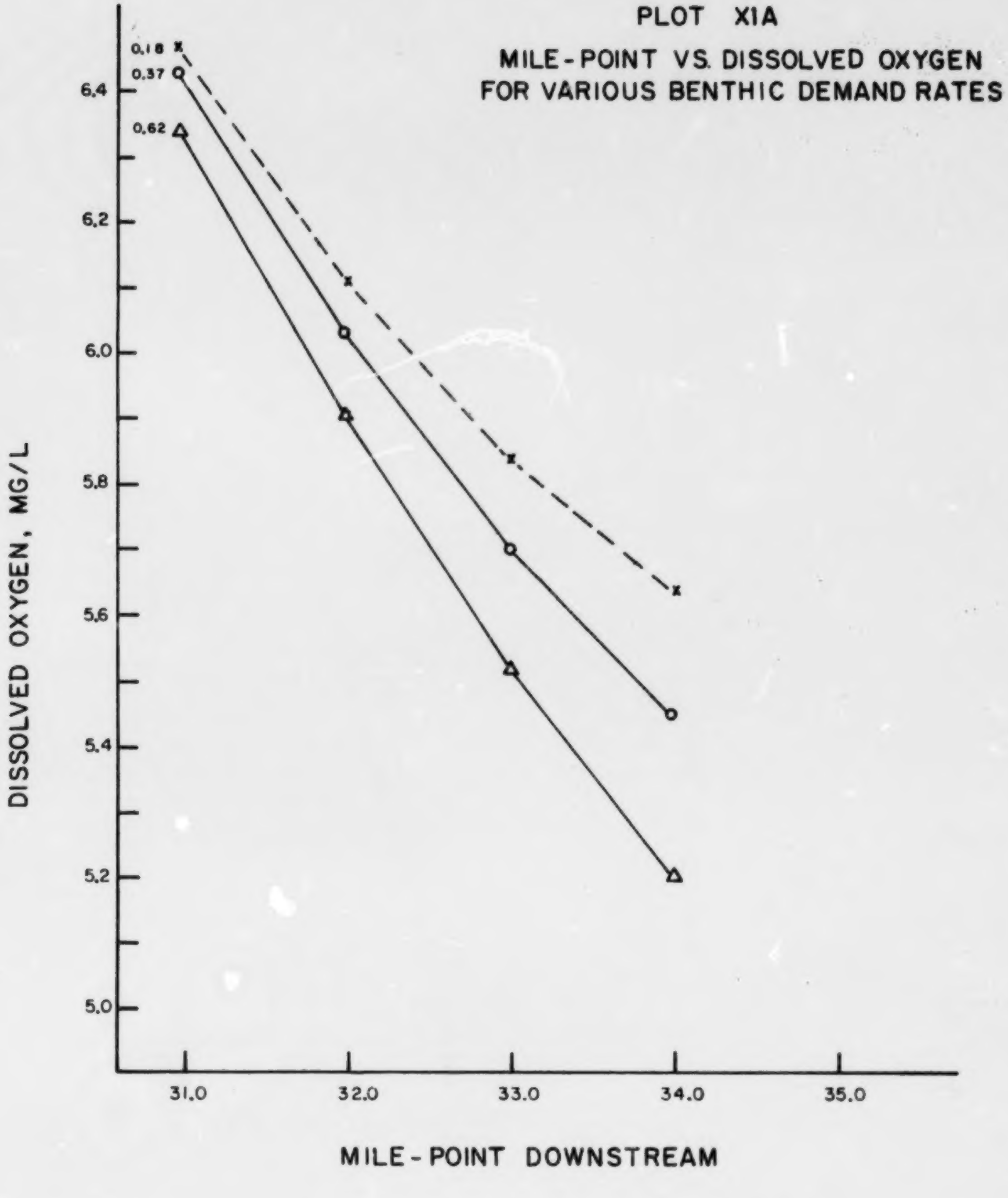

Figure 50 Mile-Point vs. Dissolved Oxygen for various Benthic Demand Rates

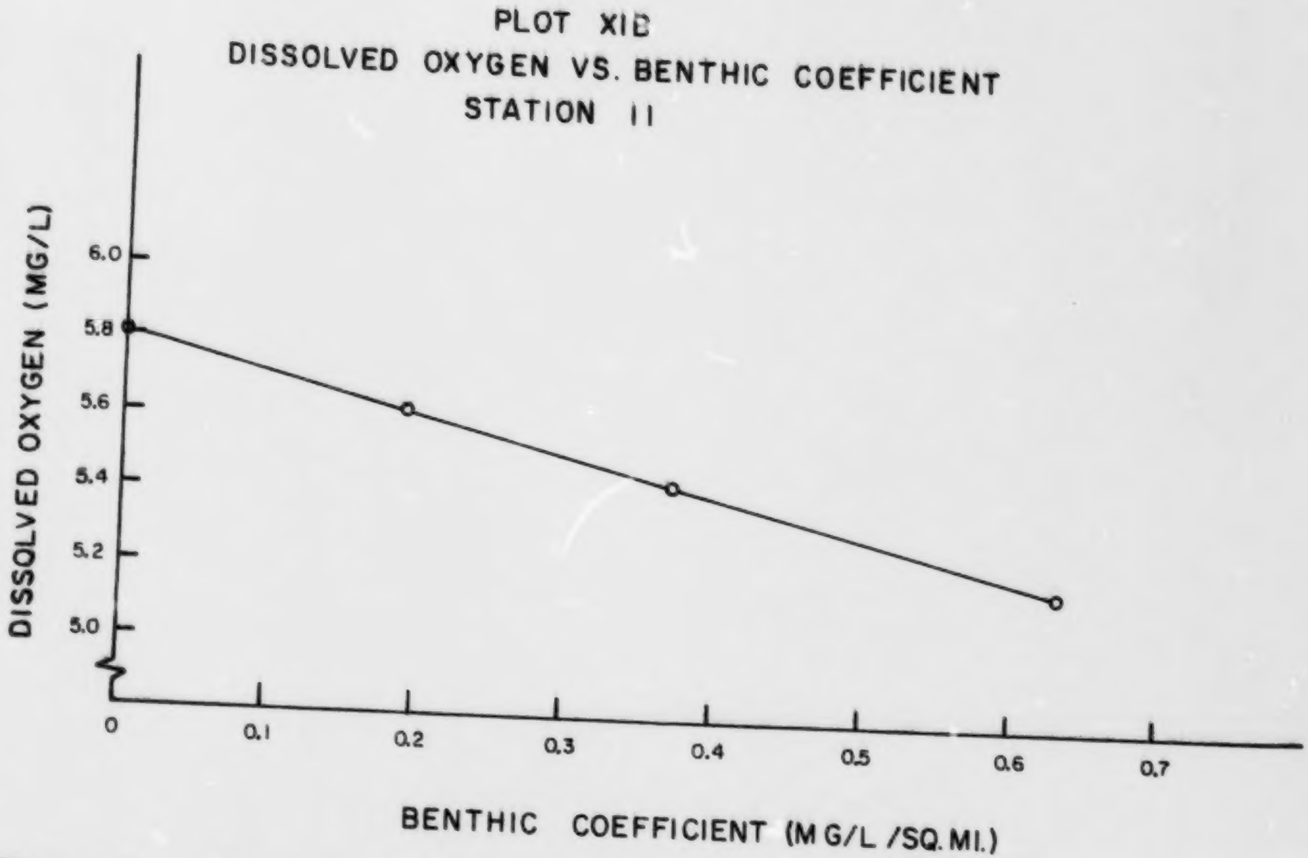

Figure 51. Dissolved Oxygen vs. Benthic Coefficient at Station 11

SECTION IX

PROJECTED EFFECTS OF BPCTCA AND BATEA ON THE WATER QUALITY OF THE GENESEE RIVER

As was pointed out in Section VII, the application of BPCTCA treatment to industrial wastewater discharges and secondary treatment to municipal discharges will increase the concentration of dissolved oxygen projected in the critical lower reaches of the Genesee River by 0.24 mg/l when compared to existing conditions under Average River Flow*. Under conditions of critical low flow (MA7CD/10), the level of dissolved oxygen is anticipated to increase 0.37 mg/l upon the implementation of BPCTCA to industrial discharges and secondary treatment to municipal discharges.

The application of BPCTCA will most certainly involve reductions in more than the level of oxygen demanding species. A complete list of required effluent values interpreted under the application of BPCTCA to industries in the study area was not available at the time of this study. Table 23 shows the effluent limitations assumed under the application of BPCTCA. The effluent limitations were established from limitations generalized from a number of draft NPDES permits as well as levels felt to be attainable under the application of practicable treatment technology. The outlined BPCTCA was then applied to all the industrial discharges within the study area and the reduction in loading to the Genesee River within the study area subsequently established as listed in Table 23. It was also assumed that all municipal discharges are upgraded to secondary treatment with phosphorus removal to a level of 1 mg/l. The composite industrial and municipal loading reductions are thus those listed in Table 23. Please note that reductions in heavy metals in municipal discharges normally encountered in the course of tertiary treatment have not been considered. Additionally, no consideration has been given to the reduction of constituents being discharged via combined sewer overflow discharges under both dry and wet weather conditions.

A review of Table 24 shows that considerable reductions in heavy metals, suspended solids and toxicants would be realized upon implementation of BPCTCA to industrial discharges and secondary treatment with tertiary phosphorus removal in municipal discharges.

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* Average River Flow is defined as the average flow encountered in the course of conducting the sampling program.

Table 23. Effluent Limitations Assumed Under Application of BPCTCA

Parameter	BPCTCA Effluent Limits mg/l	Reduced Loading to Genesee R. lbs/day as a Result of BPCTCA Application
pH	6.5 - 8.5	None
Temp(°C)	N/A	N/A
DO	N/A	N/A
BOD$_5$	85% reduction	
TOC	85% reduction	
TKN	85% reduction	
NH$_3$(N)	2.0	442.0
OrgN	85% reduction	
NO$_2$N	N/A	N/A
NO$_3$N	N/A	N/A
T-IP	1.00	1676.1
Cl	N/A	N/A
F	0.10	None
SO$_4$	N/A	N/A
Cn	0.05	81.2
Phenol	0.10	None
As	0.10	1138.7
Ba	90% reduction	1905.7
Cd	0.05	34.9
Cr	0.20	None
Cu	0.20	57.4
Fe	0.50	185.9
Hg	0.05	None
Ni	0.50	None
Pb	0.05	None
Se	90% reduction	None
Zn	0.50	None
TS	N/A	101,441
VS	N/A	N/A
TSS	25.0	101,441
VSS	N/A	N/A
TDS	N/A	N/A
VDS	N/A	N/A

Table 24. Projected Concentration of Constituents Within Genesee River at a Point Prior to Discharge to Lake Ontario Under Application** of BPCTCA

Parameter	Calculated % Reduction in Loading	Projected Conc. as a Result of BPCTCA Application*
pH	N/A	8.1
Temp ($^{\circ}$C)	N/A	25.1°C
DO	4.4%	5.64
BOD$_5$		
TOC		
TKN		
OrgN		
NO$_2$-N	N/A	0.029
NO$_3$-N	N/A	0.10
T-IP		
Cl	N/A	66.6
F	None	0.02
SO$_4$	N/A	88.1
CN	50.1%	0.018
Phenol	None	0.018
As	None	0.00
Ba	13.6	0.27
Cd	96.3	0.003
Cr	None	0.08
Cu	31.2	0.03
Fe	7.6	0.50
Hg	None	0.0034
Ni	None	0.70
Pb	None	0.00
Se	None	0.002
Zn	None	0.056
TS	4.8	395.3
VS	N/A	96.3
TSS	52.7	22.6
VSS	N/A	12.6
TDS	N/A	372.6
VDS	N/A	83.5

* Concentration is measured mg/l unless otherwise noted

** Calculations assume conservative species except for oxygen demanding species.

SECTION X

IMPACT OF GENESEE RIVER ON LAKE ONTARIO

The average concentrations and total loadings of constituents measured within the Genesee River at Station 11 (Stutson Street Bridge) are shown on Table 25. The average concentrations represent those measured at Station 11 on the eight sampling dates (July 18-19, Aug. 1-2, Aug. 15-16, Sept. 10-11, Sept. 12-13, Sept. 13-14, Sept. 26-27 and Oct. 18-19) completed during the baseline survey. The Genesee River average flow figure utilized in compiling the loadings was taken as the average flow measured at Driving Park on the eight sampling dates plus the average discharge from the Eastman Kodak waste treatment plant and the Irondequoit-St. Paul municipal waste treatment plant.

In reviewing the contents of Table 25, it can be seen that in the area of nutrient contribution to Lake Ontario, the Genesee River contributed an average of 4,557 lb/day of ammonia nitrogen, 2,572 lb/day of organic nitrogen, 451 lb/day of nitrate nitrogen, and 496 lb/day of total inorganic phosphate over the sampling period.

In the area of toxicant loading, the Genesee River contributed approximately 81 lb/day of phenols, 32 lb/day of cadmium, 15 lb/day of mercury, 252 lb/day of Zn and 162 lb/day of cyanides.

Most important to the Lake Ontario basin and in particular to the Rochester Embayment Area was the contribution of total solids, to the extent of 1,872,895 lb/day. Of the total solids load, the component of suspended solids amounted to nearly 192,254 lb/day with a dissolved solids component of nearly 1,681.544 lb/day. The influence of the suspended solids component can be quickly assessed by analyzing the 0.6 to 0.7 monometer spectral channel of the multispectral imagery obtained by the NASA ERTS-1 satellite. A readily observable plume can be observed which extended its influence eastward along the southern shore of Lake Ontario as well as in the immediate embayment area.

The Multi Spectral Scanner also revealed intense algal activity within the immediate embayment area as well as along the eastern southern shoreline. Lake Ontario has long been known to be dominated by a yearly intense growth of Cladophora in the spring and summer months (82). By far the greatest source of nutrients to Lake Ontario is contributed by the Niagara River reflecting the nutrient-rich waters of Lake Erie(83). However the nutrient load from the Genesee River is very significant along the southern shoreline and in particular the embayment area.

The Genesee River has the fourth highest annual mean flow of all the tributaries to Lake Ontario, (2,726 cfs). Those having higher flows in order of importance include Niagara River (202,000 cfs), Oswego River (6,200 cfs) and the Black River (3,828). The Genesee River contributes 1.3% of the total flow to Lake Ontario(84). As far as concentrations are concerned, only the Oswego River has been reported to contribute a flow having a greater concentration of nutrients than the Genesee River.

Table 25. **Total Load to Lake Ontario from the Genesee River**

Measured over Duration of Study

Parameter	Conc. mg/l	Loading lbs/day
pH	8.1	– –
Temp (^{o}C)	25.1	– –
DO	5.4	24,370
BOD$_5$	3.2	14,443
TOC	9.0	40,621
TKN	1.58	7,130
NH$_3$N	1.01	4,558
ORGN	0.57	2,572
NO$_2$N	0.029	120
NO$_3$N	0.10	451
T-IP	0.11	496
Cl	66.6	300,566
F	0.02	90
SO$_4$	88.1	398,244
CN	0.036	162
Phenol	0.018	81
As	0.00	0
Ba	0.31	1,399
Cd	0.007	32
Cr	0.08	361
Cu	0.043	185
Fe	0.54	2,437
Hg	0.0034	15
Ni	0.07	316
Pb	0.0	0
Se	0.002	9
Zn	0.056	252
TS	415.3	1,872,895
VS	96.3	430,602
TSS	42.6	192,254
VSS	12.6	56,864
TDS	372.6	1,681,544
VDS	83.5	376,935

Note: Loadings are based on an average Genesee River flow of 543.81 MGD.

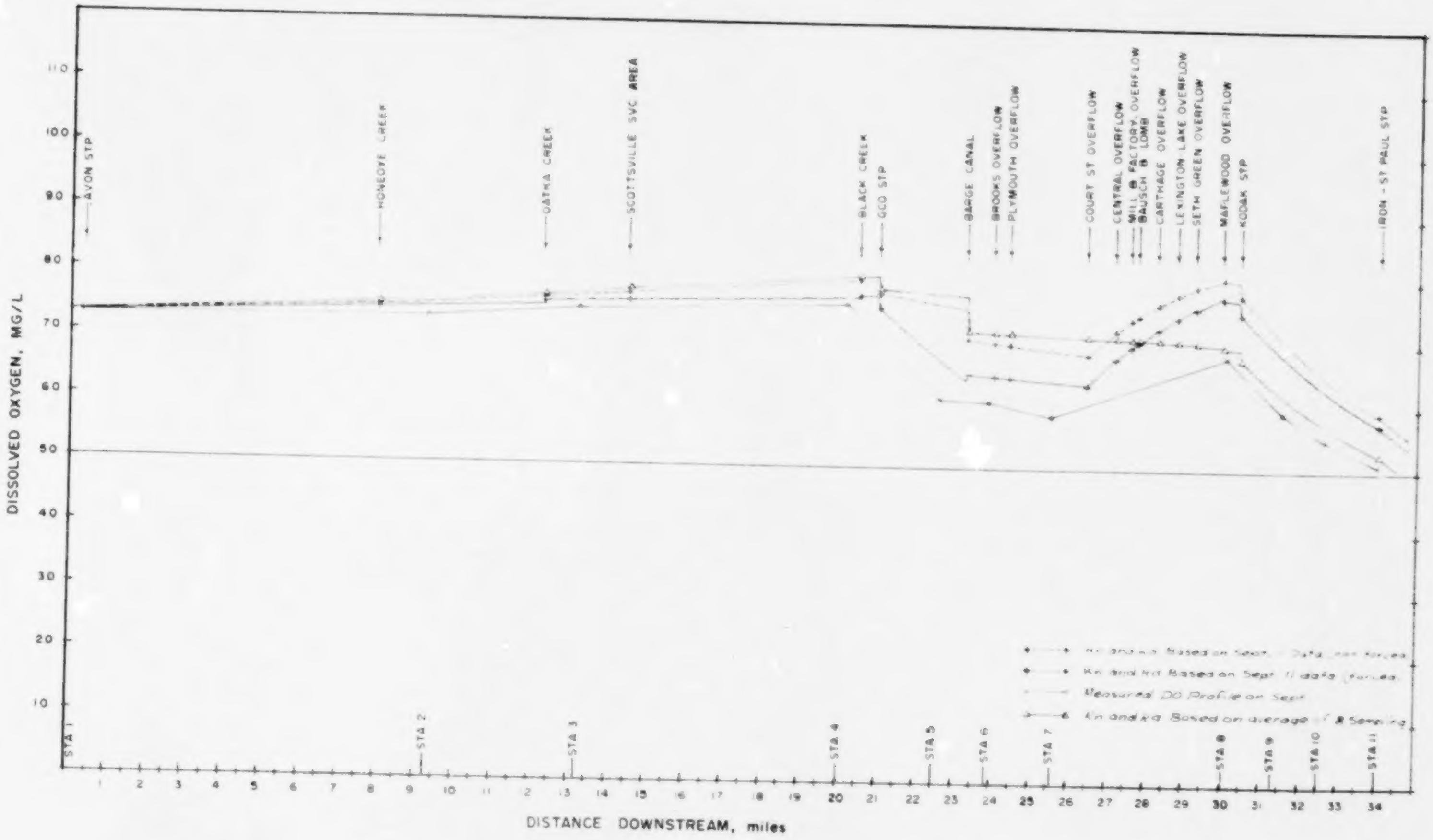

Figure 52. Comparison of DO Profiles for data on September 11,1973

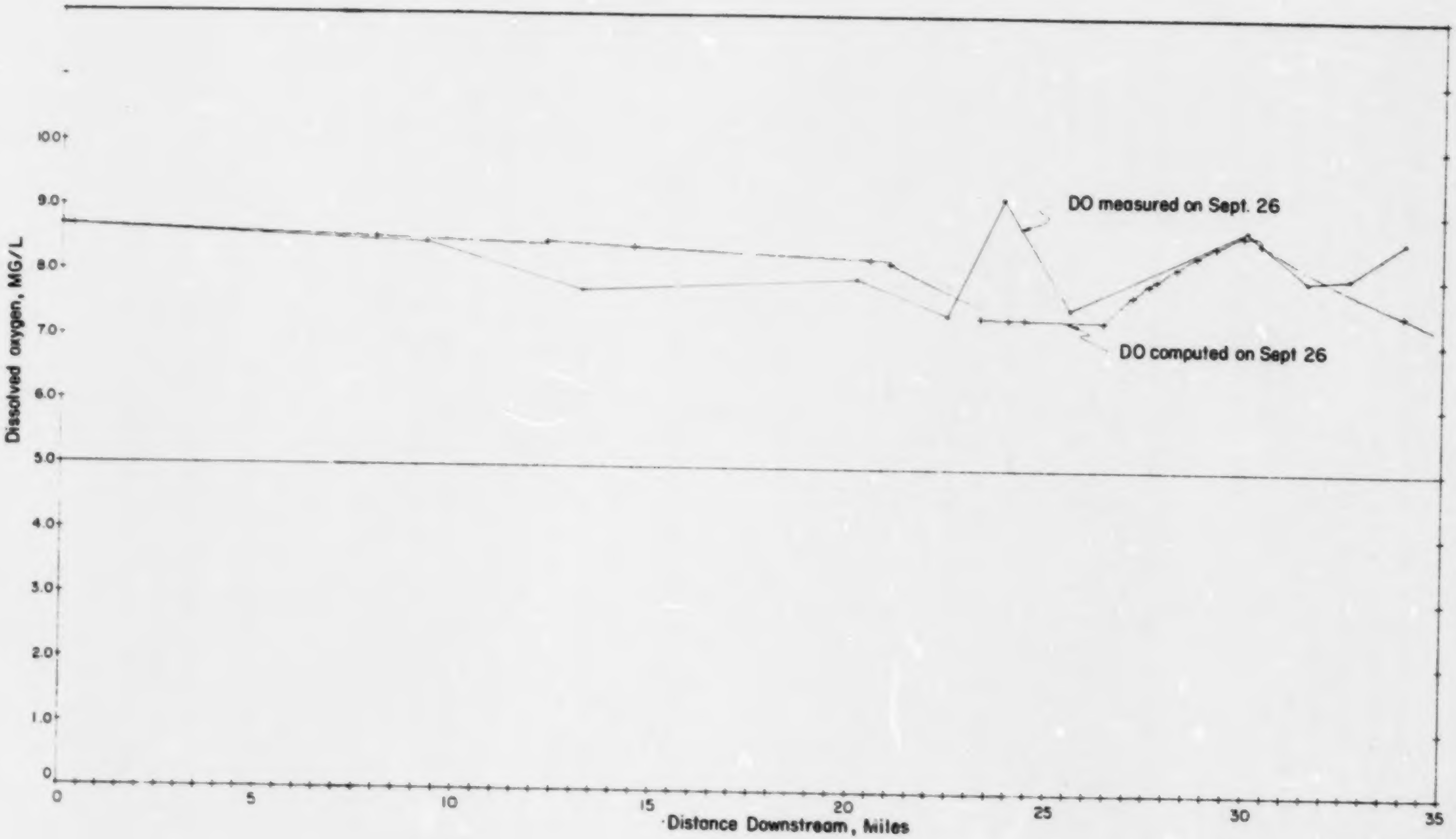

Figure 53. Comparison of DO Profiles for Data on September 11, 1973

SECTION XI

MODEL LIMITATIONS AND SENSITIVITY

TRIBUTARY QUALITY OF BARGE CANAL WATERS

Water quality data for the Barge Canal waters was obtained from the New York State Department of Environmental Conservation Water Quality Surveillance Network publications.(2) Values of parameters serving as input to the model, i.e. BOD, NH_3N, Org-N for the loading of the Barge Canal to the Genesee River under average flow conditions were taken from the 50 percentile figures. The concentrations utilized for critical low flow conditions were taken from the 90 percentile readings. Values of dissolved oxygen for average and minimum flow conditions were taken from the 50% percentile and the 10% percentile readings,respectively.

Flow figures representing the Barge Canal contribution to the Genesee were obtained from the Rochester Gas and Electric Corporation who are responsible for daily regulation of the Canal level to provide a minimum flow of 375 cfs from the Canal to the River for power generation purposes. However, at times when the locks are opened to accommodate navigational traffic, the flow of the Canal may deviate from the 375 cfs level. During the summer of 1973 a study was conducted by NYSDEC in an attempt to determine the mixing patterns created by the discharge of Canal waters to the river at the point of intrusion. However, these patterns were found to be so variable that no definite conclusions could be reached. For these reasons and for the purpose of this study, the model assumes an instantaneous complex mix of Canal and river waters at the point of confluence and continuous flow contribution of 375 cfs from the Barge Canal. Use of other data would require an in-depth study of the navigational traffic patterns of the area, flow variations and mixing patterns at the point of discharge. Thus the projected DO sag curve may not be truly representative of that section of river immediately upstream or downstream of the Canal.

VERTICAL STRATIFICATION DOWNSTREAM OF ROCHESTER FALLS

A general analysis of the analytical data acquired in the course of conducting the sampling and analysis program has not indicated any strong stratification in the vertical plane at any point on the river. From analyses of the temperature and DO data as discussed previously in Section IV, there existed little temperature differential as a function of depth at each sampling station although substantial temperature differences were observed between lake and river waters. DO values were significant in some instances, particularly samplings 1, 2 and 3 where DO differentials from top to bottom in the river were as high as 5.8 mg/l (Station 9). However, the DO differentials were generally less than 1.0 mg/l. Since the measured temperature differential as a function of depth was minimal, stratification in the river was not a significant influence on the two-dimensional modeling performed under this study.

REAERATION RATES IN THE ROCHESTER FALLS AREA

Due to the limited sampling program established for this study and the limited accessibility in the vicinity of the Rochester falls, no effort was made to establish a sampling station in this region. Reaeration rates in the reach were estimated to approximate those in the reaches just prior and just subsequent to the falls area. Obviously the cascading of water over a falls will result in higher oxygen levels measured in the receiving stream since the surface area for the water-to-air interface is greatly increased. However, the driving mechanism for oxygen transfer is the relative concentrations of DO in the water as compared to saturation DO levels. Since the DO concentration measured under this study, immediately upstream of the falls was already relatively high (80% of saturation DO) the reaeration rate was found to be an insignificant influence on the critical DO levels in the river.

In Figure 52, four DO sag curves are depicted to illustrate the effects of changing the deoxygenation coefficients in the reaches downstream of the Gates-Chili-Ogden Sewage Treatment Plant discharge and the reoxygenation coefficients in the reach between Stations 7 and 8 to simulate reaeration of the river water as it passes over the falls. K_n and K_d were first calculated based on stream survey data collected on one day, September 11, 1973. A reaeration coefficient, K_3 was then estimated for the falls reach. With this data then applied to the model, the resulting DO sag curve labeled "K_n and K_d based on September 11 data (non-forced)" shows the dissolved oxygen to be 8.03 mg/l at Station 8 as compared to the DO measured on that date of 6.80 mg/l. This amounts to a difference of 1.23 mg/l in this reach. Since the projected DO for this case was significantly higher than the observed DO, the deoxygenation coefficient in the reach just below the GCO STP was increased nearly fourfold from 0.109/day to a value of 0.450/day in an attempt to force the projected DO sag curve to more closely match observed data. The resulting curve is labeled "K_n and K_d based on September 11 data (forced)". The forced DO curve more nearly matches observed data in the reaches between GCO and the Kodak discharge. However, below Kodak the sag curves of both the forced and non-forced conditions were much higher than observed data - in the order of 0.75 mg/l.

Also depicted in Figure 52 is the DO sag curve projected by applying oxygenation coefficients calculated from data averaged over the entire eight samplings. Although this DO profile does not closely match the observed data of September 11 in the reach from GCO to Kodak, it does closely match observed data downstream of Kodak. The latter reach is the most critical in that it is the section of river that will most likely be in violation of the stream standards.

Although an attempt was made to determine what effects a high dam reaeration would have on the River, it is important to note that the value of the reaeration coefficient in that reach was arbitrary. The actual reaeration coefficient could only be determined through a complete, comprehensive detailed study of all the factors involved in oxygen transfer in the reach. Such a study was outside the scope of the straight forward modeling originally requested under this study. By assuming the reaeration rate to be lower than is reality it may be, the DO levels are calculated on the conservative side for the section of river immediately influenced by the reaeration caused by the falls.

Figure 53 illustrates the effect of verifying the model from the input data of September 26, 1973. Anomolies at Stations 6 and 11 are evident when comparing measured data to the modeled DO results. Verification of the model based on data from a one-day sampling was not considered to be generally representative of what was occurring in the stream. Since any one sampling can reflect anomolies not applicable to another, projections made from the "average" K's resulted in matching the field data in the critical downstream reach more closely than did force-fitting the K rates derived from one sampling. The original purpose of more frequent sampling was to dampen out any day-to-day anomolies and to avoid reflecting them in projections of future conditions.

LAKE BOUNDARY CONDITIONS

In projecting the DO profile for the lower reaches of the Genesee River, Lake Ontario was considered to be an infinite sink for the organic load carried by the river. This assumption becomes significant when including horizontal estuarine effects. From Water Quality Surveillance Data, 1967-1970, station number 03-L002, located in the embayment area, it is seen that the BOD_5 level for the waters of Lake Ontario is less than 1.0 mg/l fifty percent of the time and less than 1.5 mg/l 90% of the time. The DO level measured in the lake in this study was 9.2 mg/l 50% of the time. As observed in Figure 36, the combination of oxygen demand loading and benthic demand of the river depressed the DO level in the lower reaches under average conditions to a value of approximately 5.2 mg/l.

By considering Lake Ontario an infinite sink, the assumption is that the lake waters upon dispersion contribute no organic loading but at the same time contribute no dissolved oxygen to the river. However, the assumption that DO is not contributed by the lake is somewhat compensated for by the use of actual existing DO data in calculating the deoxygenation and reoxygenation coefficients in the lower reaches. By setting boundary conditions such that BOD=0.0 mg/l and DO=0.0 mg/l, the lower reaches have been modeled slightly on the conservative side. Other boundary conditions applied at the lake/river interface may slightly increase the DO projections.

ESTIMATION OF DRY WEATHER OVERFLOWS IN ROCHESTER

At the present time a study of the combined sewer overflow system in the City of Rochester is being undertaken by the Monroe County Division of Pure Waters. The project was established to determine both the volume and constituents characteristic of the combined sewer overflows to the Genesee River. Some of the data gathered to date by this project was used as input to the model in the reaches where dry-weather overflows currently exist. The complete information relative to the volumes and strength of constituents occurring in the overflows as a result of stromwater runoff were not available at the time the modeling of the Genesee River was undertaken, therefore, no attempt was made to project a DO sag curve under wet weather conditions.

However, a rough estimate of the effects of the stormwater overflow problem in Rochester was made. Results of a preliminary data-gathering phase indicated that for an average rainfall of three hours duration at an intensity of 0.09 inches per hour, a total of approximately 250 million gallons of stormwater overflow at a BOD_5 level of 100 mg/l is discharged directly to the Genesee River. This is equivalent to approximately 210,000 lbs/day of BOD_5. It is expected that such a loading of BOD_5 alone (not including nitrogenous material) would significantly depress the DO in the river to levels well below 5.0 mg/l during storm periods. Further study of the overflow problem to be conducted under the Monroe County program will further define this effect.

At present there are three overflow locations in the City of Rochester which discharge to the Genesee continuously during periods of dry-weather. However, the total volume of these three overflows is estimated at 7.0 mgd or approximately 1.4% of the total river volume. Even though they contribute a high organic loading (11,800 lb/day), upon dilution, the effect is to decrease the DO a total of 0.07 mg/l. Although the effect of dry-weather overflows on the DO sag curve is minimal, other factors such as the presence of pathogenic bacteria and virus in the discharges make it desirable to control their discharge to the Genesee River.

PHOTOSYNTHETIC EFFECTS ON THE RIVER AND EMBAYMENT AREAS

The effects of photosynthesis on the dissolved oxygen sag curve were not measured under this study. Photosynthetic production of oxygen occurs during the daylight hours while during the nighttime hours oxygen is consumed (respiration). In general, photosynthetic production rates and respiration rates fall within an approximate range of 10-25 grams per square meter per day. In streams of approximately 10 feet in depth the photosynthetic production rates fall below 5 g/m^2/day and become small by contrast to other factors in the oxygen balance and generally may be discounted by assuming it is balanced by the net respiration. During the critical DO periods of August and September, daylight hours and hours of darkness are roughly the same and again respiration may result in little or no oxygen contribution to the stream by photosynthetic oxygen production.(74)

In the Genesee River occasional algal blooms occur but the locations of the blooms are spotty and of varying size. It was not the intent of the model to predict the DO sag curve in such detail as a significantly larger sampling effort and model verification procedure would be necessary. It is felt that such occasional photosynthetic activity as may occur will not significantly affect the DO levels in the river.

SECTION XII

SUMMARY

This study of the Genesee River, conducted as part of the "Investigation of Eleven Special Attention Areas in the Great Lakes Region" revealed a river of tremendous potential and equal problems. Both chemical analyses of the receiving stream and biological studies of the aquatic structure indicate a deterioration in the water quality as one proceeds from the upstream reaches to the Rochester Harbor. The most significant change in water quality appears to occur after the intersection of the Barge Canal and the Genesee River.

The water quality of the Genesee River is most significantly affected by the following factors:

1. Severe soil erosion occurring in the upper reaches of the river resulting in extreme variations in turbidity

2. Deteriorated water quality from the Barge Canal, particularly at times of low flow conditions

3. Dredging activity in the Rochester harbor area

4. Combined sewer overflows from the City of Rochester

5. Industrial and municipal discharges of nutrients, heavy metals, and oxygen demanding constituents

6. Benthic demand exerted in the lower 6 miles of the Genesee River

7. Horizontal estuarine effect at the mouth of the Genesee River

8. Non-point source nutrient and oxygen demand contribution from cultivated and forested components of the drainage basin

The results of the assimilation capacity modeling indicates that the projected level of dissolved oxygen within the Genesee River will not be significantly improved if the degree of required treatment is extended beyond secondary treatment for municipal discharges and BPCTCA for industrial discharges. However, it is acknowledged that industrial and municipal treatment plants within the study area should have restrictions on the levels of heavy metals (particularly Zn and Cu) as well as nutrients largely in the form of $NH_3(N)$ and total inorganic phosphate.

Another area recognized as required attention involves the problem of combined sewer overflows discharging to the Genesee River within the urban environment of Rochester. There are estimated to be approximately 30 system overflows discharging directly to the Genesee River under wet weather conditions. These wet weather discharges contribute heavy loads of total suspended solids, nutrients, heavy metals, grease and oils and oxygen demanding constituents to the Genesee River. The suspended matter discharged to the receiving stream is believed to account to a large measure for the benthic oxygen demanding deposits observed in the lower reaches of the River.

It is very difficult to describe the present status of the Genesee River in qualitative terms. However, in comparing the study measured concentrations of the Genesee River prior to its intrusion into Lake Ontario, we find that the levels of most pollutants are about 2-3 times higher than the corresponding levels in the Lake measured at a point just west of the embayment area. Further pollution control capital expenditures are required, although these must be evaluated on a cost/benefit basis, particularly in light of the energy and material resource demands associated with the operation of such facilities.

SECTION XIII

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SECTION XIV

APPENDICES

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B.	Chemical and Physical Measurements Conducted on the Genesee River	163
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APPENDIX A - COMPUTER PROGRAM AND SELECTED MODEL RUN

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10/23/74

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// JOB

LOG DRIVE   CART SPEC   CART AVAIL  PHY DRIVE
  0000        0010        0010        0001
                          0020        0002
                          0050        0005
                          0510        0006
                          0520        0007
                          0550        000A

V2 M11   ACTUAL 16K  CONFIG 16K

// FOR
               *LIST ALL
               *ONE WORD INTEGERS
               *IOCS(CARD,DISK,1403 PRINTER,TYPEWRITER,PLOTTER)
               *ORIGIN 510
               *NAME ASIM5
               ** ASIM5 - SAME AS ASIM4 EXCEPT WITH EPA'S VERSION OF DEFICIT EQUASION
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PAGE  2    2/4/74     ASIM5 - SAME AS ASIM4 EXCEPT WITH EP   VERSION OF DEFICIT EQUASION

C-ERRS...STNO.C.....  F O R T R A N   S O U R C E   S T A T E M E N T S  ........  IDENTFCN    **COMPILER MESSAGES**
            C
                  DIMENSION IOPT(4), ITIT(29), KARD(80), LCARD(80), XIN(13), XK(40,3
                 1), E(40), NAME(40,14), D(40), V(40), T(40), F(40), DO(40), ODC(40)
                 2, ODN(40), TT(40), IHAVE(40), VARS(6), B(40), A(40)
            C
                  DATA LCARD/80*'9'/
            C
                  DEFINE FILE 1(32000,13,U,I1)
            C
                  WRITE(1,1)
                1 FORMAT('ASIM5 BEGINNING')
            C
                  YTOP = 28.0
                  IFRST = 1
            C
            C-----READ DATE CARD
            C
                  READ(2,12) NMO, NDAY, NYR
               12 FORMAT(3I2)
            C
            C-----READ AN OPTION CARD
            C
               80 READ(2,2) ITYP, XSIZE, YSIZE, REFL, YMIN, YMAX, YINT, XINT, IOPT,
                 1          CINT, PINT, IREPT, ITIT
                2 FORMAT(I1,7F5.0,4I1,2F5.0,I1,29A1)
                  IF(ITYP - 9)90,880,880
               90 KGO = IOPT(1)
            C
                  ALBN = 1.E30
                  N = 0
                  LINE = 100
                  MLINE = 51
                  IPAGE = 1
                  NRCH = 0
                  XMIN = 0.0
                  YYMIN = ALBN
                  YYMAX = -ALBN
                  IREPT = IREPT + 1
            C
            C
            C-----READ INITIAL CONDITION CARD
            C
                  READ(2,3) DOSAT, DO, VO, TO, FO, DOC, ODCO, ODNO, XK10, XK20,
                 1          XK30, EO, BO, AO
                3 FORMAT(10X,14F5.0)
                  IF(TO)100,100,110
              100 TO = DO / VO
              110 IF(DO)120,120,130
              120 DO = TO * VO
              130 IF(VO)140,140,200
              140 VO = DO / TO
            C
            C-----READ REACH CARDS
            C
              200 READ(2,4) KARD
                4 FORMAT(80A1)
```

```
C-ERRS...STNO.C..... F O R T R A N   S O U R C E   S T A T E M E N T S ........ IDENTFCN    **COMPILER MESSAGES**
                    IF(NCOMP(KARD,1,80,LCARD,1))210,400,210
                210 IMIS = 0
                    N = 0
                    DO 230 I = 1,3
                    XIN(I) = GETS(KARD,16+5*(I-1),20+5*(I-1),ALBN,ALBN)
                    IF(XIN(I) - ALBN)230,220,220
                220 IMIS = I
                    N = N + 1
                230 CONTINUE
                    IF(N - 1)240,260,250
                240 IF((ABS(XIN(2) * XIN(3) - XIN(1)) / XIN(1)) - 0.01)300,300,250
                250 PAUSE 1111
                    GO TO 200
                260 GO TO(270,280,290), IMIS
                270 XIN(1) = XIN(2) * XIN(3)
                    GO TO 300
                280 XIN(2) = XIN(1) / XIN(3)
                    GO TO 300
                290 XIN(3) = XIN(1) / XIN(2)
                300 DC 310 I = 4,7
                    XIN(I) = GETS(KARD,16+5*(I-1),20+5*(I-1),0.0,ALBN)
                    IF(XIN(I) - ALBN)310,250,250
                310 CONTINUE
                    DO 340 I = 8,10
                    XIN(I) = GETS(KARD,16+5*(I-1),20+5*(I-1),ALBN,ALBN)
                    IF(XIN(I) - ALBN)340,320,320
                320 IF(NRCH)250,250,330
                330 XIN(I) = XK(NRCH,I-7)
                340 CONTINUE
                    XIN(11) = GETS(KARD,66,70,ALBN,ALBN)
                    IF(XIN(11) - ALBN)380,350,350
                350 IF(NRCH)360,360,370
                360 XIN(11) = 0.0
                    GO TO 380
                370 XIN(11) = E(NRCH)
                380 XIN(12) = GETS(KARD,71,75,0.,0.)
                    XIN(13) = GETS(KARD,76,80,0.,0.)
              C
              C-----UPDATE DATA ARRAYS
              C
                    NRCH = NRCH + 1
                    DO 390 I = 2,15
                390 NAME(NRCH,I-1) = KARD(I)
                    D(NRCH) = XIN(1)
                    V(NRCH) = XIN(2)
                    T(NRCH) = XIN(3)
                    F(NRCH) = XIN(4)
                    DO(NRCH) = XIN(5)
                    ODC(NRCH) = XIN(6)
                    ODN(NRCH) = XIN(7)
                    XK(NRCH,1) = XIN(8)
                    XK(NRCH,2) = XIN(9)
                    XK(NRCH,3) = XIN(10)
                    E(NRCH) = XIN(11)
                    B(NRCH) = XIN(12)
                    A(NRCH) = XIN(13)
```

```
C-ERRS...STNO.C..... F O R T R A N   S O U R C E   S T A T E M E N T S ........ IDENTFCN    **COMPILER MESSAGES**
          GO TO 200
      C
      C-----CALCULATE STARTING TIME FOR EACH REACH
      C
        400 IGO = IOPT(3)
            GO TO(410,420), IGO
        410 TT(1) = DO / VO
            GO TO 430
        420 TT(1) = TO
        430 DO 440 I = 2,NRCH
            TT(I) = TT(I-1) + T(I-1)
        440 CONTINUE
            TOTTM = TT(NRCH) + T(NRCH)
      C
      C-----PRINT INPUT
      C
            WRITE(5,13) IPAGE, ITIT
         13 FORMAT('1',20X,'STREAM ASSIMILATION CAPACITY',23X,'PAGE ',I3,/,'0'
           1,21X,29A1,/,'OINPUT CONDITIONS',/,'0',16X,'REACH',16X,'START',51X,
           3'ESTU. BENTH. BOTTOM',/,'   REACH NAME   LENGTH VELOC.  TIME   TIM
           3E   FLOW   D.O.   COD    NOD    K1     K2     K3    CONST DEMAND
           4 AREA',/,' ',14('-'),14(' ------'))
            WRITE(5,8) DO, VO, TO, FO, DOO, DDCO, DDNO, XK10, XK20, XK30, EO,
           1           BO, AO
          8 FORMAT(' ',14X,3F7.2,7X,4F7.2,4F7.3,2F7.2)
            WRITE(5,14) DOSAT
         14 FORMAT('OOXYGEN SATURATION LEVEL = ',F5.2,/)
            DO 445 I = 1,NRCH
            WRITE(5,9) (NAME(I,J), J = 1,14), D(I), V(I), T(I), TT(I), F(I),
           1           DO(I), DDC(I), DDN(I), (XK(I,J), J = 1,3), E(I), B(I),
           2           A(I)
          9 FORMAT(' ',14A1,8F7.2,4F7.3,2F7.2)
        445 CONTINUE
      C
      C-----INITIALIZE
      C
            DO 446 I = 1,NRCH
        446 IHAVE(I) = 0
            O2 = DOO
            O2DCO = DDCO
            O2DNO = DDNO
            O2DBO = BO
            O2DC = DDCO
            O2DN = DDNO
            O2DH = 0.0
            XK1 = XK10
            XK2 = XK20
            XK3 = XK30
            EUSE = EO
            VUSE = VO
            DUSE = DOSAT - DOO
            AUSE = AO
            PRNT = 0.0
            DIST = 0.0
            TIME = 0.0
            TIMEO = 0.0
```

```
C-ERRS...STNO.C..... F O R T R A N   S O U R C E   S T A T E M E N T S ........ IDENTFCN   **COMPILER MESSAGES**
                NEW = 2
                NOW = 2
                N = 0
                GO TO(450,460), IGO
            450 CI = CINT / VO
                PI = PINT / VO
                FACT = CINT / DO
                GO TO 465
            460 CI = CINT
                PI = PINI
                FACT = CINT * VO / DO
          C
          C-----CHECK FOR START OF NEW REACH
          C
            465 DO 510 I = 1,NRCH
                IF(ABS(TT(I) - TIME) - CI/2.)470,470,510
            470 IF(IHAVE(I))480,480,510
          C
          C-----CALCULATE NEW INITIAL CONDITIONS
          C
            480 TIMEO = TT(I)
                NEW = 1
                NOW = 1
                IHAVE(I) = 1
                EUSE = E(I)
                VUSE = V(I)
                AUSE = A(I)
                KRCH = I
                XK1 = XK(I,1)
                XK2 = XK(I,2)
                XK3 = XK(I,3)
                O2OB = 0.0
                GO TO(481,482), IGO
            481 CI = CINT / V(I)
                PI = PINT / V(I)
                FACT = CINT / D(I)
                GO TO 483
            482 CI = CINT
                PI = PINT
                FACT = CINT * V(I) / D(I)
            483 JGO = IOPT(4)
                GO TO(490,500), JGO
          C-----INPUT IN MG/L (CONCENTRATION)
            490 DOO = (FO * O2 + F(I) * DO(I)) / (FO + F(I))
                O2DCO = (FO * O2DC + F(I) * ODC(I)) / (FO + F(I))
                O2DNO = (FO * O2DN + F(I) * ODN(I)) / (FO + F(I))
                O2DBO = B(I)
                FO = FO + F(I)
                GO TO 515
          C-----INPUT IN POUNDS
            500 DOO = 8.34 * O2  * FO + DO(I)
                O2DCO = 8.34 * O2DC * FO + ODC(I)
                O2DNO = 8.34 * O2DN * FO + ODN(I)
                FO = FO + F(I)
                DOO = DOO / (8.34 * FO)
                O2DCO = O2DCO / (8.34 * FO)
```

```
PAGE   6     2/4/74     ASIM5 - SAME AS ASIM4 EXCEPT WITH EPA'S VERSION OF DEFICIT EQUASION

C-ERRS...STNO.C.....  F O R T R A N   S O U R C E   S T A T E M E N T S  ........  IDENTFCN    **COMPILER MESSAGES**
                O2DNO = O2DNO / (8.34 * FO)
                O2DBO = B(I) / (8.34 * FO)
            515 DUSE = DOSAT - DOO
                GO TO 520
            510 CONTINUE
          C
          C-----CALCULATE CURRENT CONCENTRATION LEVELS
          C
          C
          C-----ESTUARIAN FACTOR
          C
            520 IF(EUSE)530,530,540
            530 XJ1 = XK1
                XJ2 = XK2
                XJ3 = XK3
                GO TO 550
            540 XJ1 = VUSE*SQRT(XK1/EUSE)
                XJ2 = VUSE*SQRT(XK2/EUSE)
                XJ3 = VUSE*SQRT(XK3/EUSE)
            550 TUSE = TIME - TIMEO
          C-----CARBONACEOUS OXYGEN DEMAND
                O2DC = O2DCO * EXP(-XJ1*TUSE)
                IF(O2DC)5550,5551,5551
           5550 O2DC = 0.0
          C-----NITROGENEOUS OXYGEN DEMAND
           5551 O2DN = O2DNO * EXP(-XJ2*TUSE)
                IF(O2DN)5552,5553,5553
           5552 O2DN = 0.0
          C-----BENTHIC OXYGEN DEMAND
           5553 O2DB = O2DB + O2DBO * FACT * AUSE
          C-----TOTAL OXYGEN DEMAND
                O2DT = O2DC + O2DN + O2DB
          C-----OXYGEN DEFICIT
                DEF = ((XK1*O2DCO)/(XK3-XK1))*(EXP(-XJ1*TUSE)-EXP(-XJ3*TUSE)) +
               1      ((XK2*O2DNO)/(XK3-XK2))*(EXP(-XJ2*TUSE)-EXP(-XJ3*TUSE)) +
               2      DUSE*EXP(-XJ3*TUSE) +
               3      O2DB
                IF(DEF)5554,5555,5555
           5554 DEF = 0.0
          C-----DISSOLVED OXYGEN
           5555 O2 = DOSAT - DEF
                IF(O2)5556,5557,5557
           5556 O2 = 0.0
          C
          C-----WRITE TO FILE, CHECK FOR MAXIMUMS AND MINIMUMS
          C
           5557 GO TO(551,552,553,554,555), KGO
            551 YTRY = DOSAT - DEF
                GO TO 556
            552 YTRY = DEF
                GO TO 556
            553 YTRY = O2DC + O2DN
                GO TO 556
            554 YTRY = O2DC
                GO TO 556
            555 YTRY = O2DN
```

```
             556 IF(YTRY - YYMIN)557,558,558
             557 YYMIN = YTRY
             558 IF(YTRY - YYMAX)5590,5590,559
             559 YYMAX = YTRY
            5590 N = N + 1
                 WRITE(1'N) TIME, DIST, O2DC, O2DN, O2DB, DEF, NOW
                 NOW = 2
           C
           C-----CHECK FOR PRINTING
           C
                 IF(PINT)600,600,560
             560 IF(ABS(TIME - PRNT) - CI)570,570,600
             570 IF(LINE - NLINE)590,580,580
             580 LINE = 0
                 IPAGE = IPAGE + 1
                 WRITE(5,5) IPAGE, ITIT, NMO, NDAY, NYR
               5 FORMAT('1',46X,'STREAM ASSIMILATION CAPACITY',38X,'PAGE ',I3,/,'0'
                1,46X,29A1,22X,'REPORT PRINTED ',2(I2,'/'),I2,/,'0',16X,24('-'),' O
                2XYGEN DEMAND ',24('-'),' ---- OXYGEN ---',/,' ',18X,'CARBONACEOUS
                3  NITROGENEOUS',7X,'BENTHIC',10X,'TOTAL',6X,'DEFICIT  LEVEL     FLO
                4W',/,'    TIME   DIST.',4X,4('MG/L   POUNDS    '),'MG/L    MG/L    M
                5GD',/,' ',13('------- '))
             590 XIN( 1) = TIME + .005
                 XIN( 2) = DIST + .005
                 XIN( 3) = O2DC + .005
                 XIN( 4) = 8.34 * FO * O2DC + .5
                 XIN( 5) = O2DN + .005
                 XIN( 6) = 8.34 * FO * O2DN + .5
                 XIN( 7) = O2DB + .005
                 XIN( 8) = 8.34 * FO * O2DB + .5
                 XIN( 9) = O2DT + .005
                 XIN(10) = 8.34 * FO * O2DT + .5
                 XIN(11) = DEF + .005
                 XIN(12) = O2 + .005
                 XIN(13) = FO + .005
                 WRITE(5,6) XIN
               6 FORMAT(' ',F7.2,F8.2,4(F8.2,F8.0),3F8.2)
                 LINE = LINE + 1
                 PRNT = PRNT + PI
                 GO TO(591,600), NEW
             591 WRITE(5,10) (NAME(KRCH,J), J = 1,14)
              10 FORMAT('+',104X,14A1)
                 NEW = 2
           C
           C-----INCREMENT TIME
           C
             600 IF(TIME - TOTTM)610,620,620
             610 TIME = TIME + CI
                 DIST = DIST + CI * VUSE
                 GO TO 465
           C
           C-----CHECK FOR PLOTTING
           C
             620 IF(XSIZE)880,880,630
             630 IF(YSIZE)880,880,640
             640 IF(IOPT(2) - 1)650,650,660
```

```
C-ERRS...STNO.C..... FORTRAN SOURCE STATEMENTS ........ IDENTFCN   **COMPILER MESSAGES**
          650 XMAX = DIST
              GO TO 670
          660 XMAX = TIME
          670 GO TO(671,676), IREPT
          671 GO TO(672,673), IFRST
          672 IFRST = 2
              XLAST = 0.0
              YLAST = -1.0
              YAM = 0.0
              XBIG = 0.0
              CALL SCALF(1.,1.,0.,0.)
              CALL FPLOT(1,2.,-31.)
              CALL SCALF(1.,1.,0.,0.)
              CALL FPLOT(1,0.,1.)
          673 CALL SCALF(1.,1.,0.,0.)
              IF((YAM + YLAST + YSIZE + 1.0) - YTOP)674,674,675
          674 CALL FPLOT(1,0.,1.0+YLAST)
              YAM = YAM + YLAST + 1.0
              GO TO 676
          675 CALL FPLOT(1,1.0+XBIG,-YAM)
              XBIG = 0.0
              YAM = 0.0
        C
        C-----SCALE
        C
          676 XRANG = XMAX - XMIN
              IF(XINT)680,680,690
          680 XINT = XRANG
          690 INTX = 0
          695 INTX = INTX + 1
              IF((XMIN + XINT * FLOAT(INTX)) - XMAX)695,700,700
          700 XMAX = XMIN + XINT * FLOAT(INTX)
              XRANG = XMAX - XMIN
              IF(YMAX)710,710,720
          710 YMAX = YYMAX
          720 IF(YMIN)730,730,740
          730 YMIN = 0.0
          740 YRANG = YMAX - YMIN
              IF(YINT)750,750,760
          750 YINT = YRANG
          760 INTY = 0
          765 INTY = INTY + 1
              IF((YMIN + YINT * FLOAT(INTY)) - YMAX)765,770,770
          770 YMAX = YMIN + YINT * FLOAT(INTY)
              YRANG = YMAX - YMIN
              X1 = XSIZE / XRANG
              Y1 = YSIZE / YRANG
              CALL SCALF(X1,Y1,XMIN,YMIN)
        C
              GO TO(771,772), IREPT
          771 CALL FGRID(0,XMIN,YMIN,XINT,INTX)
              CALL FGRID(1,XMAX,YMIN,YINT,INTY)
              CALL FPLOT(2,XMIN,YMAX)
              CALL FGRID(3,XMIN,YMAX,YINT,INTY)
        C
        C-----PLOT POINTS
```

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PA   9    2/4/74      ASIM5 - SAME AS ASIM4 EXCEPT WITH   S VERSION OF DEFICIT EQUASION

C-ERRS...STNO.C.....  F O R T R A N   S O U R C E   S T A T E M E N T S  ........  IDENTFCN    **COMPILER MESSAGES**
          C
            772 DO 870 I = 1,N
                READ(1'I)  VARS, NEW
                GO TO(860,810), IGO
            800 X = VARS(2)
                GO TO 820
            810 X = VARS(1)
            820 GO TO(821,822,823,824,825), KGO
            821 Y = DOSAT - VARS(6)
                GO TO 830
            822 Y = VARS(6)
                GO TO 830
            823 Y = VARS(3) + VARS(4) + VARS(5)
                GO TO 830
            824 Y = VARS(3)
                GO TO 830
            825 Y = VARS(4)
            830 IF(Y - YMAX)832,831,831
            831 Y = YMAX
            832 IF(Y - YMIN)833,834,834
            833 Y = YMIN
            834 IF(I - 1)840,840,850
            840 CALL FPLOT(1,X,Y)
                CALL FPLOT(2,X,Y)
            850 CALL FPLOT(0,X,Y)
                GO TO(860,870), NEW
            860 CALL POINT(0)
            870 CONTINUE
                IF(REFL - YMIN)872,872,871
            871 CALL FPLOT(1,XMAX,REFL)
                CALL FPLOT(2,XMIN,REFL)
            872 CALL FPLOT(1,XMIN,YMIN)
                XLAST = XSIZE
                YLAST = YSIZE
                IF(XLAST - XBIG)80,80,873
            873 XBIG = XLAST
                GO TO 80
          C
          C-----PROGRAM COMPLETE
          C
            880 WRITE(1,7)
              7 FORMAT('ASIM5 COMPLETED')
                CALL EXIT
                END
VARIABLE ALLOCATIONS
    XIN(R  )=021E-0206     XK(R  )=030E-0220      E(R  )=035E-0310      D(R  )=03AE-0360      V(R  )=03FE-0380      T(R  )=044E-0400
      F(R  )=049E-0450     DO(R  )=04EE-04A0    ODC(R  )=053E-04F0    ODN(R  )=058E-0540     TT(R  )=05DE-0590   VARS(R  )=05EA-05E0
      B(R  )=063A-05EC      A(R  )=068A-063C   YTOP(R  )=068C       XSIZE(R  )=068E      YSIZE(R  )=0690      REFL(R  )=0692
   YMIN(R  )=0694        YMAX(R  )=0696       YINT(R  )=0698        XINT(R  )=069A       CINT(R  )=069C      PINT(R  )=069E
   ALBN(R  )=06A0        XMIN(R  )=06A2      YYMIN(R  )=06A4       YYMAX(R  )=06A6      DOSAT(R  )=06A8        DO(R  )=06AA
     VO(R  )=06AC          TO(R  )=06AE         FO(R  )=06B0          DDO(R  )=06B2       ODCO(R  )=06B4      ODNO(R  )=06B6
   XK10(R  )=06B8        XK20(R  )=06BA       XK30(R  )=06BC           EO(R  )=06BE         BO(R  )=06C0        AO(R  )=06C2
  TOTTM(R  )=06C4          O2(R  )=06C6      O2DCO(R  )=06C8        O2DNO(R  )=06CA      O2DBO(R  )=06CC      O2DC(R  )=06CE
   O2DN(R  )=06D0        O2DB(R  )=06D2        XK1(R  )=06D4          XK2(R  )=06D6        XK3(R  )=06D8      EJSL(R  )=06DA
   VUSE(R  )=06DC        DUSE(R  )=06DE       AUSE(R  )=06E0         PRNT(R  )=06E2       DIST(R  )=06E4      TIME(R  )=06E6
  TIMEO(R  )=06E8          CI(R  )=06EA         PI(R  )=06EC         FACT(R  )=06EE        XJ1(R  )=06F0       XJ2(R  )=06F2
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PA )10    2/4/74     ASIMS - SAME AS ASIM4 EXCEPT WITH E )S VERSION OF DEFICIT EQUASION                         )
     Z.3(R )=06F4         TUSE(R )=06F6         D2DT(R )=06F8         DEF(R )=06FA          YTRY(R )=06FC         XMAX(R )=06FE
   XLAST(R )=0700        YLAST(R )=0702          YAM(R )=0704        XBIG(R )=0706        XRANG(R )=0708        YRANG(R )=070A
     Z1(R )=070C           Y1(R )=070E            X(R )=0710           Y(R )=0712         IOPT(I )=0731-072E   IIIII(I )=074C-0732
   KARD(I )=079E-074F LCARD(I )=C7EE-079F  NAME(I )=0A1E-07EF IHAVE(I )=0A46-0A1F      III(I )=0A47        IFRST(I )=0A48
    NMO(I )=0A49         NDAY(I )=0A4A          NYR(I )=0A4B        ITYP(I )=0A4C        IREPT(I )=0A4D          KGO(I )=0A4E
      N(I )=0A4F         LINE(I )=0A50        NLINE(I )=0A51       IPAGE(I )=0A52        NRCH(I )=0A53         INIS(I )=0A54
      I(I )=0A55          IGO(I )=0A56            J(I )=0A57         NEW(I )=0A58         NOW(I )=0A59        KRCH(I )=0A5A
    ISD(I )=0A5B         INTX(I )=0A5C         INTY(I )=0A5D

STATEMENT ALLOCATIONS
      1=0A9A      12=0AA4       2=0AA7       3=0AB2       4=0AB6      13=CAD9       8=0B44      14=CB51       9=0B63       5=0B6E
      6=0C11      10=0C1C       7=CC22      80=0C5A      90=CC7F     100=0CD4     110=0CDA     120=0CDF     130=0CE5     140=0CEA
    200=0CF0     210=0CFF     220=0D3A     230=0D44     240=0D55     250=0D6F     260=0D73     270=0D7A     280=0D88     290=0D96
    300=0DA2     310=0DD5     320=0E11     330=0E15     340=0E27     350=0E44     360=0E48     370=0E50     380=0E5B     390=0E73
    400=0F0F     410=0F1B     420=0F25     430=0F2B     440=CF41     445=0FD1     446=0FDE     450=104C     460=1060     465=1070
    470=108D     480=1096     481=10C8     482=1105     483=111A     490=1126     500=1141     515=1102     516=110A     520=11C3
    530=11E8     540=11F6     550=1210    5550=1236    5551=123A    5552=1240    5553=1251    5554=1200    5555=1204    5556=120F
   5557=12C3     551=12EC     552=12F4     553=12FA     554=1302     555=1308     556=130C     557=1313     558=1317     559=131F
   5560=1322     560=1343     570=1351     580=1357     590=1370     591=1401     600=141E     610=1425     620=1435     630=143A
    640=143F     650=1447     660=1440     670=1451     671=1457     672=1450     673=148D     674=14A0     675=14B5     676=14C0
    680=1408     690=140C     695=14C0     700=14F2     710=1506     720=150A     730=150F     740=1513     750=151E     760=1522
    765=1526     770=1538     771=155F     772=1577     800=158B     810=1593     820=1599     821=15A2     822=15AC     823=15B4
    824=15C4     825=15CC     830=15D2     831=15D9     832=15DD     833=15E4     834=15E8     840=15EE     850=15F8     860=1603
    870=1606     871=1616     872=1620     873=1634     880=163A

FEATURES SUPPORTED
 ONE WORD INTEGERS
 STANDARD PRECISION
 ORIGIN
 IOCS-
  PLOTTER
  DISK
  1403 PRINTER
  TYPEWRITER
  CARD

CALLED SUBPROGRAMS
 NCOMP    GETS     FABS     FSQRT    FEXP     SCALF    FPLOT    FGRID    POINT    FADD     FADDX    FSUB     FSUBX    FMPY     FMPYX
 FDIV     FDIVX    FLD      FLDX     FSTO     FSTOX    FSBR     FDVR     FDVRX    FLOAT    WRTYZ    CARDZ    WCHRI    SRED     SWRT
 SCOMP    SFIO     SIOAI    SIOAF    SIOFX    SIOIX    SIOF     SIOI     SUBSC    PRNZ     PAUSE    STOP     SDFIO    SDRED    SDWRT
 SCOM     SDAF     SDF      SDI

REAL CONSTANTS
  .230000E 02=0A6E    .100000E 31=0A70    .000000E 00=0A72    .100000E-01=0A74    .200000E 01=0A76    .834000E 01=0A78
  .500000E-02=0A7A    .500000E 00=0A7C    .100000E 01=0A7E    .310000E 02=0A80

INTEGER CONSTANTS
      1=0A82       2=0A83       9=0A84       0=0A85     100=CA86      51=0A87      80=0A88       3=0A89      16=0A8A       5=0A8B
     20=0A8C    1111=0A8D       4=0A8E       7=0A8F       8=0A90      10=0A91      66=0A92      70=0A93      71=0A94      75=0A95
     76=0A96      15=0A97      14=0A98    4369=0A99

CORE REQUIREMENTS FOR - ASIMS
 COMMON-      0,   VARIABLES AND TEMPORARIES-  2160,   CONSTANTS AND PROGRAM-  1026

END OF SUCCESSFUL COMPILATION

// DUP

*DELETE             ASIMS
```

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P.  11    2/4/74
CART ID 001D   DB ADDR  421E   DB CNT   000B

*STORE       WS  UA  ASIM5
CART ID 001D   DB ADDR  4330   DB CNT   000B

*DELETE               ASIM4
CART ID 001D   DB ADDR  421E   DB CNT   000B
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                    STREAM ASSIMILATION CAPACITY                                        PAGE   1

                    PRESENT LOADINGS - AVG.COND
INPUT CONDITIONS

                  REACH              START
  REACH NAME     LENGTH VELOC.  TIME  TIME    FLOW    D.O.    COD     NOD     K1     K2     K3    ESTU. BENTH. BOTTOM
                                                                                                  CONST DEMAND  AREA
--------------- ------ ------ ------ ------ ------ ------ ------ ------ ------ ------ ------ ------ ------ ------
                  0.30   8.20   0.00        214.00   7.80   3.24   1.76  0.081  0.076  0.209  0.000   0.00   0.00
OXYGEN SATURATION LEVEL =  9.20

 NO INFLOW        0.30   8.20   0.03   0.00   0.00   0.00   0.00   0.00  0.080  0.075  0.208  0.000   0.00   0.00
 AVON STP         7.70   8.20   0.93   0.03   1.00   4.00  60.00  60.00  0.080  0.075  0.208  0.000   0.00   0.00
 HONEOYE CREEK    4.30   7.35   0.58   0.97   1.20   8.00   2.17   2.83  0.080  0.075  0.208  0.000   0.00   0.00
 OATKA CREEK      2.20   7.35   0.29   1.56  22.00  10.80   1.00   4.00  0.080  0.075  0.318  0.000   0.00   0.00
 SCOTTSVILLE      6.00   7.22   0.82   1.85   0.00   4.00  87.50  87.50  0.080  0.075  0.318  0.000   0.00   0.00
 BLACK CREEK      0.50   7.40   0.06   2.68  15.00   8.00   2.17   2.83  0.067  0.060  0.208  0.000   0.00   0.00
 GCO STP          2.30   7.40   0.31   2.75  11.90   4.00  74.00  74.00  0.067  0.060  0.208  0.000   0.00   0.00
 BARGE CANAL      0.70   7.17   0.09   3.06 242.00   6.60   5.71   3.27  0.070  0.063  0.205  0.000   0.00   0.00
 BROOKS SW        0.40   7.35   0.05   3.16   0.00   0.00   0.00   0.00  0.070  0.063  0.208  0.000   0.00   0.00
 PLYMOUTH SW      2.00   7.60   0.26   3.22   0.00   0.00   0.00   0.00  0.070  0.063  0.208  0.000   0.00   0.00
 COURT SW         0.75   7.60   0.09   3.48   2.00   2.00  22.47  32.51  0.070  0.063  0.210  0.000   0.00   0.00
 CENTRAL SW       0.40   7.60   0.05   3.58   0.00   0.00   0.00   0.00  0.070  0.063  0.210  0.000   0.00   0.00
 MILL-FACTORY     0.20   7.60   0.02   3.63   0.00   0.00   0.00   0.00  0.070  0.063  0.210  0.000   0.00   0.00
 BAUSCH & LOMB    0.50   7.60   0.06   3.66   0.10   4.00  12.50  12.50  0.070  0.063  0.210  0.000   0.00   0.00
 CARTHAGE SW      0.50   7.60   0.06   3.72   0.00   0.00   0.00   0.00  0.070  0.063  0.210  0.000   0.00   0.00
 LEXINGTON SW     0.50   7.60   0.06   3.79   0.00   0.00   0.00   0.00  0.070  0.063  0.210  0.000   0.00   0.00
 SETH GREEN SW    0.70   7.60   0.09   3.85   2.00   2.00 164.40  35.60  0.070  0.063  0.210  0.000   0.00   0.00
 MAPLEWOOD SW     0.45   8.15   0.05   3.94   3.00   2.00 290.00   5.50  0.090  0.084  0.155  0.000   0.00   0.00
 KODAK STP        3.60   7.55   0.47   4.00  28.00   4.00  35.80  56.70  0.090  0.084  0.120 10.000   0.62   1.00
 IRON-ST PAUL     0.70   7.92   0.08   4.48   1.25   4.00  73.25  73.25  0.085  0.101  0.047 10.000   0.13   0.74
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                                              STREAM ASSIMILATION CAPACITY                                           PAGE   2

                                              PRESENT LOADINGS - AVG.COND                                  REPORT PRINTED  2/ 4/74

                      ----------------------- OXYGEN DEMAND ----------------------- ---- OXYGEN ---
                      CARRONACEOUS    NITROGENEOUS       BENTHIC          TOTAL     DEFICIT  LEVEL    FLOW
   TIME    DIST.     MG/L   POUNDS   MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS   MG/L    MG/L     MGD
  ------- -------   ------- -------  ------- -------  ------- -------  ------- ------- ------- ------- -------
    0.00    0.00     3.24   5783.     1.76   3141.     0.00      0.     5.00   8924.    1.40    7.80  214.00  NO INFLOW
    0.01    0.05     3.24   5780.     1.76   3140.     0.00      0.     5.00   8919.    1.40    7.80  214.00
    0.02    0.20     3.23   5771.     1.76   3135.     0.00      0.     4.99   8907.    1.40    7.80  214.00
    0.04    0.30     3.50   6269.     2.03   3634.     0.00      0.     5.52   9903.    1.42    7.78  215.00  AVON STP
    0.05    0.40     3.49   6263.     2.02   3631.     0.00      0.     5.52   9894.    1.42    7.78  215.00
    0.06    0.50     3.49   6256.     2.02   3628.     0.00      0.     5.51   9884.    1.42    7.78  215.00
    0.07    0.60     3.49   6250.     2.02   3624.     0.00      0.     5.51   9874.    1.43    7.77  215.00
    0.09    0.70     3.48   6244.     2.02   3621.     0.00      0.     5.50   9865.    1.43    7.77  215.00
    0.10    0.80     3.48   6238.     2.02   3618.     0.00      0.     5.50   9855.    1.43    7.77  215.00
    0.11    0.90     3.48   6232.     2.02   3614.     0.00      0.     5.49   9846.    1.43    7.77  215.00
    0.12    1.00     3.47   6226.     2.01   3611.     0.00      0.     5.49   9836.    1.43    7.77  215.00
    0.13    1.10     3.47   6219.     2.01   3607.     0.00      0.     5.48   9827.    1.43    7.77  215.00
    0.15    1.20     3.47   6213.     2.01   3604.     0.00      0.     5.48   9817.    1.44    7.76  215.00
    0.16    1.30     3.46   6207.     2.01   3601.     0.00      0.     5.47   9808.    1.44    7.76  215.00
    0.17    1.40     3.46   6201.     2.01   3597.     0.00      0.     5.46   9798.    1.44    7.76  215.00
    0.18    1.50     3.45   6195.     2.00   3594.     0.00      0.     5.46   9789.    1.44    7.76  215.00
    0.20    1.60     3.45   6189.     2.00   3591.     0.00      0.     5.45   9780.    1.44    7.76  215.00
    0.21    1.70     3.45   6183.     2.00   3587.     0.00      0.     5.45   9770.    1.44    7.76  215.00
    0.22    1.80     3.44   6177.     2.00   3584.     0.00      0.     5.44   9761.    1.44    7.76  215.00
    0.23    1.90     3.44   6170.     2.00   3581.     0.00      0.     5.44   9751.    1.45    7.75  215.00
    0.24    2.00     3.44   6164.     2.00   3577.     0.00      0.     5.43   9742.    1.45    7.75  215.00
    0.25    2.05     3.44   6161.     1.99   3576.     0.00      0.     5.43   9737.    1.45    7.75  215.00
    0.26    2.15     3.43   6155.     1.99   3573.     0.00      0.     5.43   9728.    1.45    7.75  215.00
    0.27    2.25     3.43   6149.     1.99   3569.     0.00      0.     5.42   9718.    1.45    7.75  215.00
    0.29    2.35     3.43   6143.     1.99   3566.     0.00      0.     5.41   9709.    1.45    7.75  215.00
    0.30    2.45     3.42   6137.     1.99   3563.     0.00      0.     5.41   9700.    1.45    7.75  215.00
    0.31    2.55     3.42   6131.     1.98   3559.     0.00      0.     5.40   9690.    1.46    7.74  215.00
    0.32    2.65     3.42   6125.     1.98   3556.     0.00      0.     5.40   9681.    1.46    7.74  215.00
    0.34    2.75     3.41   6119.     1.98   3553.     0.00      0.     5.39   9672.    1.46    7.74  215.00
    0.35    2.85     3.41   6113.     1.98   3549.     0.00      0.     5.39   9662.    1.46    7.74  215.00
    0.36    2.95     3.41   6107.     1.98   3546.     0.00      0.     5.38   9653.    1.46    7.74  215.00
    0.37    3.05     3.40   6101.     1.98   3543.     0.00      0.     5.38   9644.    1.46    7.74  215.00
    0.38    3.15     3.40   6095.     1.97   3540.     0.00      0.     5.37   9634.    1.46    7.74  215.00
    0.40    3.25     3.40   6089.     1.97   3536.     0.00      0.     5.37   9625.    1.47    7.73  215.00
    0.41    3.35     3.39   6083.     1.97   3533.     0.00      0.     5.36   9616.    1.47    7.73  215.00
    0.42    3.45     3.39   6077.     1.97   3530.     0.00      0.     5.36   9606.    1.47    7.73  215.00
    0.43    3.55     3.39   6071.     1.97   3526.     0.00      0.     5.35   9597.    1.47    7.73  215.00
    0.45    3.65     3.38   6065.     1.96   3523.     0.00      0.     5.35   9588.    1.47    7.73  215.00
    0.46    3.75     3.38   6059.     1.96   3520.     0.00      0.     5.34   9579.    1.47    7.73  215.00
    0.47    3.85     3.38   6053.     1.96   3517.     0.00      0.     5.34   9569.    1.47    7.73  215.00
    0.48    3.95     3.37   6047.     1.96   3513.     0.00      0.     5.33   9560.    1.48    7.72  215.00
    0.49    4.05     3.37   6041.     1.96   3510.     0.00      0.     5.33   9551.    1.48    7.72  215.00
    0.51    4.15     3.37   6035.     1.96   3507.     0.00      0.     5.32   9542.    1.48    7.72  215.00
    0.52    4.25     3.36   6029.     1.95   3504.     0.00      0.     5.32   9533.    1.48    7.72  215.00
    0.53    4.35     3.36   6023.     1.95   3500.     0.00      0.     5.31   9523.    1.48    7.72  215.00
    0.54    4.45     3.36   6017.     1.95   3497.     0.00      0.     5.31   9514.    1.48    7.72  215.00
    0.55    4.55     3.35   6011.     1.95   3494.     0.00      0.     5.30   9505.    1.48    7.72  215.00
    0.57    4.65     3.35   6005.     1.95   3491.     0.00      0.     5.30   9496.    1.49    7.71  215.00
    0.58    4.75     3.35   5999.     1.94   3487.     0.00      0.     5.29   9487.    1.49    7.71  215.00
    0.59    4.85     3.34   5993.     1.94   3484.     0.00      0.     5.29   9477.    1.49    7.71  215.00
    0.60    4.95     3.34   5987.     1.94   3481.     0.00      0.     5.28   9468.    1.49    7.71  215.00
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                                        STREAM ASSIMILATION CAPACITY                                          PAGE   3

                                        PRESENT LOADINGS - AVG.COND                               REPORT PRINTED  2/ 4/74

                    ------------------------- OXYGEN DEMAND ------------------------- ---- OXYGEN ---
                     CARBONACEOUS    NITROGENEOUS       BENTHIC            TOTAL       DEFICIT  LEVEL     FLOW
  TIME     DIST.     MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS    MG/L    MG/L      MGD
 -------  -------  ------- -------  ------- -------  ------- -------  ------- -------  ------- -------  -------
   0.62     5.05     3.34   5981.     1.94   3478.     0.00      0.     5.28   9459.     1.49    7.71   215.00
   0.63     5.15     3.33   5976.     1.94   3475.     0.00      0.     5.27   9450.     1.49    7.71   215.00
   0.64     5.25     3.33   5970.     1.94   3471.     0.00      0.     5.27   9441.     1.49    7.71   215.00
   0.65     5.35     3.33   5964.     1.93   3468.     0.00      0.     5.26   9432.     1.49    7.71   215.00
   0.66     5.45     3.32   5956.     1.93   3465.     0.00      0.     5.25   9423.     1.50    7.70   215.00
   0.68     5.55     3.32   5952.     1.93   3462.     0.00      0.     5.25   9414.     1.50    7.70   215.00
   0.69     5.65     3.32   5946.     1.93   3458.     0.00      0.     5.24   9405.     1.50    7.70   215.00
   0.70     5.75     3.31   5940.     1.93   3455.     0.00      0.     5.24   9395.     1.50    7.70   215.00
   0.71     5.85     3.31   5934.     1.93   3452.     0.00      0.     5.23   9386.     1.50    7.70   215.00
   0.73     5.95     3.31   5928.     1.92   3449.     0.00      0.     5.23   9377.     1.50    7.70   215.00
   0.74     6.05     3.30   5923.     1.92   3446.     0.00      0.     5.22   9368.     1.50    7.70   215.00
   0.75     6.15     3.30   5917.     1.92   3443.     0.00      0.     5.22   9359.     1.50    7.70   215.00
   0.76     6.25     3.30   5911.     1.92   3439.     0.00      0.     5.21   9350.     1.51    7.69   215.00
   0.77     6.35     3.29   5905.     1.92   3436.     0.00      0.     5.21   9341.     1.51    7.69   215.00
   0.79     6.45     3.29   5899.     1.91   3433.     0.00      0.     5.20   9332.     1.51    7.69   215.00
   0.80     6.55     3.29   5893.     1.91   3430.     0.00      0.     5.20   9323.     1.51    7.69   215.00
   0.81     6.65     3.28   5888.     1.91   3427.     0.00      0.     5.19   9314.     1.51    7.69   215.00
   0.82     6.75     3.28   5882.     1.91   3423.     0.00      0.     5.19   9305.     1.51    7.69   215.00
   0.84     6.85     3.28   5876.     1.91   3420.     0.00      0.     5.18   9296.     1.51    7.69   215.00
   0.85     6.95     3.27   5870.     1.91   3417.     0.00      0.     5.18   9287.     1.51    7.69   215.00
   0.86     7.05     3.27   5864.     1.90   3414.     0.00      0.     5.17   9278.     1.51    7.69   215.00
   0.87     7.15     3.27   5859.     1.90   3411.     0.00      0.     5.17   9269.     1.52    7.68   215.00
   0.88     7.25     3.26   5853.     1.90   3408.     0.00      0.     5.16   9260.     1.52    7.68   215.00
   0.90     7.35     3.26   5847.     1.90   3404.     0.00      0.     5.16   9251.     1.52    7.68   215.00
   0.91     7.45     3.26   5841.     1.90   3401.     0.00      0.     5.15   9243.     1.52    7.68   215.00
   0.92     7.55     3.25   5836.     1.90   3398.     0.00      0.     5.15   9234.     1.52    7.68   215.00
   0.93     7.65     3.25   5830.     1.89   3395.     0.00      0.     5.14   9225.     1.52    7.68   215.00
   0.95     7.75     3.25   5824.     1.89   3392.     0.00      0.     5.14   9216.     1.52    7.68   215.00
   0.96     7.85     3.24   5818.     1.89   3389.     0.00      0.     5.13   9207.     1.52    7.68   215.00
   0.97     7.95     3.24   5813.     1.89   3386.     0.00      0.     5.13   9198.     1.52    7.68   215.00
   0.98     8.05     3.23   5831.     1.89   3412.     0.00      0.     5.13   9243.     1.52    7.68   216.20   HONEOYE CREEK
   1.00     8.15     3.23   5825.     1.89   3409.     0.00      0.     5.12   9233.     1.52    7.68   216.20
   1.01     8.25     3.23   5818.     1.89   3405.     0.00      0.     5.12   9223.     1.52    7.68   216.20
   1.02     8.35     3.22   5812.     1.89   3402.     0.00      0.     5.11   9213.     1.53    7.67   216.20
   1.04     8.45     3.22   5805.     1.88   3398.     0.00      0.     5.10   9203.     1.53    7.67   216.20
   1.05     8.55     3.22   5799.     1.88   3395.     0.00      0.     5.10   9193.     1.53    7.67   216.20
   1.06     8.65     3.21   5793.     1.88   3391.     0.00      0.     5.09   9184.     1.53    7.67   216.20
   1.08     8.75     3.21   5786.     1.88   3387.     0.00      0.     5.09   9174.     1.53    7.67   216.20
   1.09     8.85     3.21   5780.     1.88   3384.     0.00      0.     5.08   9164.     1.53    7.67   216.20
   1.10     8.95     3.20   5773.     1.87   3381.     0.00      0.     5.08   9154.     1.53    7.67   216.20
   1.12     9.05     3.20   5767.     1.87   3377.     0.00      0.     5.07   9144.     1.53    7.67   216.20
   1.13     9.15     3.19   5761.     1.87   3374.     0.00      0.     5.07   9134.     1.53    7.67   216.20
   1.15     9.25     3.19   5754.     1.87   3370.     0.00      0.     5.06   9124.     1.54    7.66   216.20
   1.16     9.35     3.19   5748.     1.87   3367.     0.00      0.     5.05   9115.     1.54    7.66   216.20
   1.17     9.45     3.18   5742.     1.87   3363.     0.00      0.     5.05   9105.     1.54    7.66   216.20
   1.19     9.55     3.18   5735.     1.86   3360.     0.00      0.     5.04   9095.     1.54    7.66   216.20
   1.20     9.65     3.18   5729.     1.86   3356.     0.00      0.     5.04   9085.     1.54    7.66   216.20
   1.21     9.75     3.17   5723.     1.86   3353.     0.00      0.     5.03   9075.     1.54    7.66   216.20
   1.23     9.85     3.17   5716.     1.86   3349.     0.00      0.     5.03   9066.     1.54    7.66   216.20
   1.24     9.95     3.17   5710.     1.86   3346.     0.00      0.     5.02   9056.     1.54    7.66   216.20
   1.25    10.05     3.16   5704.     1.85   3342.     0.00      0.     5.02   9046.     1.54    7.66   216.20
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                                        STREAM ASSIMILATION CAPACITY
                                                                                                  PAGE    4
                                        PRESENT LOADINGS - AVG.COND
                                                                                         REPORT PRINTED  2/ 4/74
                      ------------------------- OXYGEN DEMAND ------------------------- ---- OXYGEN ---
  TIME    DIST.      CARBONACEOUS     NITROGENEOUS        BENTHIC            TOTAL      DEFICIT   LEVEL    FLOW
                     MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS    MG/L     MG/L     MGD
 -------  -------  ------- -------  ------- -------  ------- -------  ------- -------  -------  -------  -------
   1.27    10.15     3.16   5698.     1.85   3339.     0.00      0.     5.01   9036.     1.54     7.66   216.20
   1.28    10.25     3.16   5691.     1.85   3335.     0.00      0.     5.01   9027.     1.55     7.65   216.20
   1.30    10.35     3.15   5685.     1.85   3332.     0.00      0.     5.00   9017.     1.55     7.65   216.20
   1.31    10.45     3.15   5679.     1.85   3328.     0.00      0.     5.00   9007.     1.55     7.65   216.20
   1.32    10.55     3.15   5673.     1.84   3325.     0.00      0.     4.99   8998.     1.55     7.65   216.20
   1.34    10.65     3.14   5666.     1.84   3322.     0.00      0.     4.98   8988.     1.55     7.65   216.20
   1.35    10.75     3.14   5660.     1.84   3318.     0.00      0.     4.98   8978.     1.55     7.65   216.20
   1.36    10.85     3.14   5654.     1.84   3315.     0.00      0.     4.97   8969.     1.55     7.65   216.20
   1.38    10.95     3.13   5648.     1.84   3311.     0.00      0.     4.97   8959.     1.55     7.65   216.20
   1.39    11.05     3.13   5641.     1.83   3308.     0.00      0.     4.96   8949.     1.55     7.65   216.20
   1.40    11.15     3.13   5635.     1.83   3304.     0.00      0.     4.96   8940.     1.55     7.65   216.20
   1.42    11.25     3.12   5629.     1.83   3301.     0.00      0.     4.95   8930.     1.56     7.64   216.20
   1.43    11.35     3.12   5623.     1.83   3298.     0.00      0.     4.95   8920.     1.56     7.64   216.20
   1.44    11.45     3.11   5617.     1.83   3294.     0.00      0.     4.94   8911.     1.56     7.64   216.20
   1.46    11.55     3.11   5610.     1.83   3291.     0.00      0.     4.94   8901.     1.56     7.64   216.20
   1.47    11.65     3.11   5604.     1.82   3287.     0.00      0.     4.93   8892.     1.56     7.64   216.20
   1.49    11.75     3.10   5598.     1.82   3284.     0.00      0.     4.93   8882.     1.56     7.64   216.20
   1.50    11.85     3.10   5592.     1.82   3281.     0.00      0.     4.92   8873.     1.56     7.64   216.20
   1.51    11.95     3.10   5586.     1.82   3277.     0.00      0.     4.92   8863.     1.56     7.64   216.20
   1.53    12.05     3.09   5580.     1.82   3274.     0.00      0.     4.91   8853.     1.56     7.64   216.20
   1.54    12.15     3.09   5573.     1.81   3270.     0.00      0.     4.90   8844.     1.56     7.64   216.20
   1.55    12.25     3.09   5567.     1.81   3267.     0.00      0.     4.90   8834.     1.56     7.64   216.20
   1.57    12.35     2.89   5748.     2.01   3999.     0.00      0.     4.91   9747.     1.27     7.93   238.20
   1.58    12.45     2.89   5741.     2.01   3995.     0.00      0.     4.90   9736.     1.27     7.93   238.20   OATKA CREEK
   1.59    12.55     2.89   5735.     2.01   3991.     0.00      0.     4.90   9726.     1.27     7.93   238.20
   1.61    12.65     2.88   5729.     2.01   3987.     0.00      0.     4.89   9715.     1.27     7.93   238.20
   1.62    12.75     2.88   5722.     2.00   3982.     0.00      0.     4.89   9705.     1.27     7.93   238.20
   1.64    12.85     2.88   5716.     2.00   3978.     0.00      0.     4.88   9694.     1.27     7.93   238.20
   1.65    12.95     2.87   5710.     2.00   3974.     0.00      0.     4.87   9684.     1.27     7.93   238.20
   1.66    13.05     2.87   5703.     2.00   3970.     0.00      0.     4.87   9674.     1.27     7.93   238.20
   1.68    13.15     2.87   5697.     2.00   3966.     0.00      0.     4.86   9663.     1.27     7.93   238.20
   1.69    13.25     2.86   5691.     1.99   3962.     0.00      0.     4.86   9653.     1.27     7.93   238.20
   1.70    13.35     2.86   5685.     1.99   3958.     0.00      0.     4.85   9642.     1.27     7.93   238.20
   1.72    13.45     2.86   5678.     1.99   3954.     0.00      0.     4.85   9632.     1.27     7.93   238.20
   1.73    13.55     2.86   5672.     1.99   3950.     0.00      0.     4.84   9622.     1.27     7.93   238.20
   1.74    13.65     2.85   5666.     1.99   3946.     0.00      0.     4.84   9611.     1.27     7.93   238.20
   1.76    13.75     2.85   5660.     1.98   3941.     0.00      0.     4.83   9601.     1.27     7.93   238.20
   1.77    13.85     2.85   5653.     1.98   3937.     0.00      0.     4.83   9591.     1.27     7.93   238.20
   1.79    13.95     2.84   5647.     1.98   3933.     0.00      0.     4.82   9580.     1.27     7.93   238.20
   1.80    14.05     2.84   5641.     1.98   3929.     0.00      0.     4.82   9570.     1.27     7.93   238.20
   1.81    14.15     2.84   5635.     1.98   3925.     0.00      0.     4.81   9560.     1.27     7.93   238.20
   1.83    14.25     2.83   5628.     1.97   3921.     0.00      0.     4.81   9550.     1.27     7.93   238.20
   1.84    14.35     2.83   5622.     1.97   3917.     0.00      0.     4.80   9539.     1.27     7.93   238.20
   1.85    14.45     2.83   5616.     1.97   3913.     0.00      0.     4.80   9529.     1.27     7.93   238.20
   1.87    14.55     2.83   5613.     1.97   3911.     0.00      0.     4.79   9524.     1.27     7.93   238.20
   1.88    14.65     2.82   5607.     1.97   3907.     0.00      0.     4.79   9514.     1.27     7.93   238.20   SCOTTSVILLE
   1.89    14.75     2.82   5600.     1.96   3903.     0.00      0.     4.78   9503.     1.26     7.94   238.20
   1.91    14.85     2.82   5594.     1.96   3899.     0.00      0.     4.78   9493.     1.26     7.94   238.20
   1.92    14.95     2.81   5588.     1.96   3895.     0.00      0.     4.77   9482.     1.26     7.94   238.20
   1.94    15.05     2.81   5582.     1.96   3891.     0.00      0.     4.77   9472.     1.26     7.94   238.20
   1.95    15.15     2.81   5575.     1.96   3886.     0.00      0.     4.76   9462.     1.26     7.94   238.20
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                                             STREAM ASSIMILATION CAPACITY                                        PAGE   5

                                             PRESENT LOADINGS - AVG.COND                                  REPORT PRINTED  2/ 4/74

                      ----------------------- OXYGEN DEMAND ----------------------- ---- OXYGEN ---
                       CARBONACEOUS    NITROGENEOUS       BENTHIC           TOTAL        DEFICIT  LEVEL     FLOW
  TIME    DIST.       MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS    MG/L    MG/L      MGD
 ------- -------    ------- -------  ------- -------  ------- -------  ------- -------  ------- -------  -------
   1.96   15.25       2.80   5569.     1.95   3882.     0.00       0.     4.76   9451.     1.26    7.94   238.20
   1.98   15.35       2.80   5563.     1.95   3878.     0.00       0.     4.75   9441.     1.26    7.94   238.20
   1.99   15.45       2.80   5557.     1.95   3874.     0.00       0.     4.75   9431.     1.26    7.94   238.20
   2.01   15.55       2.79   5550.     1.95   3870.     0.00       0.     4.74   9421.     1.26    7.94   238.20
   2.02   15.65       2.79   5544.     1.95   3866.     0.00       0.     4.74   9410.     1.26    7.94   238.20
   2.03   15.75       2.79   5538.     1.94   3862.     0.00       0.     4.73   9400.     1.26    7.94   238.20
   2.05   15.85       2.78   5532.     1.94   3858.     0.00       0.     4.73   9390.     1.26    7.94   238.20
   2.06   15.95       2.78   5526.     1.94   3854.     0.00       0.     4.72   9379.     1.26    7.94   238.20
   2.07   16.05       2.78   5519.     1.94   3850.     0.00       0.     4.72   9369.     1.26    7.94   238.20
   2.09   16.15       2.78   5513.     1.94   3846.     0.00       0.     4.71   9359.     1.26    7.94   238.20
   2.10   16.25       2.77   5507.     1.93   3842.     0.00       0.     4.71   9349.     1.26    7.94   238.20
   2.12   16.35       2.77   5501.     1.93   3838.     0.00       0.     4.70   9339.     1.26    7.94   238.20
   2.13   16.45       2.77   5495.     1.93   3834.     0.00       0.     4.70   9328.     1.26    7.94   238.20
   2.14   16.55       2.76   5489.     1.93   3830.     0.00       0.     4.69   9318.     1.26    7.94   238.20
   2.16   16.65       2.76   5482.     1.93   3826.     0.00       0.     4.69   9308.     1.26    7.94   238.20
   2.17   16.75       2.76   5476.     1.92   3822.     0.00       0.     4.68   9298.     1.26    7.94   238.20
   2.18   16.85       2.75   5470.     1.92   3818.     0.00       0.     4.68   9288.     1.26    7.94   238.20
   2.20   16.95       2.75   5464.     1.92   3814.     0.00       0.     4.67   9278.     1.26    7.94   238.20
   2.21   17.05       2.75   5458.     1.92   3810.     0.00       0.     4.67   9268.     1.26    7.94   238.20
   2.23   17.15       2.74   5452.     1.92   3806.     0.00       0.     4.66   9257.     1.25    7.95   238.20
   2.24   17.25       2.74   5446.     1.91   3802.     0.00       0.     4.65   9247.     1.25    7.95   238.20
   2.25   17.35       2.74   5440.     1.91   3798.     0.00       0.     4.65   9237.     1.25    7.95   238.20
   2.27   17.45       2.74   5434.     1.91   3794.     0.00       0.     4.64   9227.     1.25    7.95   238.20
   2.28   17.55       2.73   5427.     1.91   3790.     0.00       0.     4.64   9217.     1.25    7.95   238.20
   2.30   17.65       2.73   5421.     1.91   3786.     0.00       0.     4.63   9207.     1.25    7.95   238.20
   2.31   17.75       2.73   5415.     1.90   3782.     0.00       0.     4.63   9197.     1.25    7.95   238.20
   2.32   17.85       2.72   5409.     1.90   3778.     0.00       0.     4.62   9187.     1.25    7.95   238.20
   2.34   17.95       2.72   5403.     1.90   3774.     0.00       0.     4.62   9177.     1.25    7.95   238.20
   2.35   18.05       2.72   5397.     1.90   3770.     0.00       0.     4.61   9167.     1.25    7.95   238.20
   2.36   18.15       2.71   5391.     1.90   3766.     0.00       0.     4.61   9157.     1.25    7.95   238.20
   2.38   18.25       2.71   5385.     1.89   3762.     0.00       0.     4.60   9147.     1.25    7.95   238.20
   2.39   18.35       2.71   5379.     1.89   3758.     0.00       0.     4.60   9137.     1.25    7.95   238.20
   2.41   18.45       2.70   5373.     1.89   3754.     0.00       0.     4.59   9127.     1.25    7.95   238.20
   2.42   18.55       2.70   5367.     1.89   3750.     0.00       0.     4.59   9117.     1.25    7.95   238.20
   2.43   18.65       2.70   5361.     1.89   3746.     0.00       0.     4.58   9107.     1.25    7.95   238.20
   2.45   18.75       2.70   5355.     1.88   3742.     0.00       0.     4.58   9097.     1.25    7.95   238.20
   2.46   18.85       2.69   5349.     1.88   3738.     0.00       0.     4.57   9087.     1.25    7.95   238.20
   2.48   18.95       2.69   5343.     1.88   3734.     0.00       0.     4.57   9077.     1.25    7.95   238.20
   2.49   19.05       2.69   5337.     1.88   3730.     0.00       0.     4.56   9067.     1.25    7.95   238.20
   2.50   19.15       2.68   5331.     1.88   3726.     0.00       0.     4.56   9057.     1.25    7.95   238.20
   2.52   19.25       2.68   5325.     1.87   3722.     0.00       0.     4.55   9048.     1.24    7.96   238.20
   2.53   19.35       2.68   5319.     1.87   3719.     0.00       0.     4.55   9038.     1.24    7.96   238.20
   2.54   19.45       2.67   5313.     1.87   3715.     0.00       0.     4.54   9028.     1.24    7.96   238.20
   2.56   19.55       2.67   5307.     1.87   3711.     0.00       0.     4.54   9018.     1.24    7.96   238.20
   2.57   19.65       2.67   5301.     1.87   3707.     0.00       0.     4.53   9008.     1.24    7.96   238.20
   2.59   19.75       2.67   5295.     1.86   3703.     0.00       0.     4.53   8998.     1.24    7.96   238.20
   2.60   19.85       2.66   5289.     1.86   3699.     0.00       0.     4.52   8988.     1.24    7.96   238.20
   2.61   19.95       2.66   5283.     1.86   3695.     0.00       0.     4.52   8979.     1.24    7.96   238.20
   2.63   20.05       2.66   5278.     1.86   3691.     0.00       0.     4.51   8969.     1.24    7.96   238.20
   2.64   20.15       2.65   5272.     1.86   3687.     0.00       0.     4.51   8959.     1.24    7.96   238.20
   2.66   20.25       2.65   5266.     1.85   3684.     0.00       0.     4.50   8949.     1.24    7.96   238.20
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STREAM ASSIMILATION CAPACITY

PRESENT LOADINGS - AVG.COND

REPORT PRINTED 2/ 4/74

		OXYGEN DEMAND								OXYGEN			
TIME	DIST.	CARBONACEOUS		NITROGENEOUS		BENTHIC		TOTAL		DEFICIT	LEVEL	FLOW	
		MG/L	POUNDS	MG/L	POUNDS	MG/L	POUNDS	MG/L	POUNDS	MG/L	MG/L	MGD	
2.67	20.35	2.65	5260.	1.85	3680.	0.00	0.	4.50	8940.	1.24	7.96	238.20	
2.68	20.45	2.64	5254.	1.85	3676.	0.00	0.	4.50	8930.	1.24	7.96	238.20	
2.70	20.55	2.62	5523.	1.91	4028.	0.00	0.	4.52	9551.	1.24	7.96	253.20	BLACK CREEK
2.71	20.65	2.61	5518.	1.91	4025.	0.00	0.	4.52	9543.	1.24	7.96	253.20	
2.72	20.75	2.61	5513.	1.90	4022.	0.00	0.	4.52	9534.	1.24	7.96	253.20	
2.74	20.85	2.61	5508.	1.90	4018.	0.00	0.	4.51	9526.	1.24	7.96	253.20	
2.75	20.95	2.61	5503.	1.90	4015.	0.00	0.	4.51	9518.	1.24	7.96	253.20	
2.76	21.05	5.81	12841.	5.14	11354.	0.00	0.	10.94	24196.	1.42	7.78	265.10	GCO STP
2.78	21.15	5.80	12830.	5.13	11345.	0.00	0.	10.93	24175.	1.42	7.78	265.10	
2.79	21.25	5.80	12818.	5.13	11336.	0.00	0.	10.92	24154.	1.43	7.77	265.10	
2.80	21.35	5.79	12807.	5.12	11326.	0.00	0.	10.92	24133.	1.43	7.77	265.10	
2.82	21.45	5.79	12795.	5.12	11317.	0.00	0.	10.91	24112.	1.44	7.76	265.10	
2.83	21.55	5.78	12783.	5.11	11308.	0.00	0.	10.90	24091.	1.45	7.75	265.10	
2.85	21.65	5.78	12772.	5.11	11298.	0.00	0.	10.89	24070.	1.45	7.75	265.10	
2.86	21.75	5.77	12760.	5.11	11289.	0.00	0.	10.88	24049.	1.46	7.74	265.10	
2.87	21.85	5.77	12749.	5.10	11280.	0.00	0.	10.87	24029.	1.46	7.74	265.10	
2.89	21.95	5.76	12737.	5.10	11271.	0.00	0.	10.86	24008.	1.47	7.73	265.10	
2.90	22.05	5.76	12726.	5.09	11261.	0.00	0.	10.85	23987.	1.47	7.73	265.10	
2.91	22.15	5.75	12714.	5.09	11252.	0.00	0.	10.84	23966.	1.48	7.72	265.10	
2.93	22.25	5.75	12703.	5.09	11243.	0.00	0.	10.83	23945.	1.48	7.72	265.10	
2.94	22.35	5.74	12691.	5.08	11233.	0.00	0.	10.82	23925.	1.49	7.71	265.10	
2.95	22.45	5.73	12680.	5.08	11224.	0.00	0.	10.81	23904.	1.49	7.71	265.10	
2.97	22.55	5.73	12668.	5.07	11215.	0.00	0.	10.80	23883.	1.50	7.70	265.10	
2.98	22.65	5.72	12657.	5.07	11206.	0.00	0.	10.79	23862.	1.50	7.70	265.10	
2.99	22.75	5.72	12645.	5.06	11196.	0.00	0.	10.78	23842.	1.51	7.69	265.10	
3.01	22.85	5.71	12634.	5.06	11187.	0.00	0.	10.77	23821.	1.51	7.69	265.10	
3.02	22.95	5.71	12622.	5.06	11178.	0.00	0.	10.76	23800.	1.52	7.68	265.10	
3.03	23.05	5.70	12611.	5.05	11169.	0.00	0.	10.76	23780.	1.52	7.68	265.10	
3.05	23.15	5.70	12600.	5.05	11160.	0.00	0.	10.75	23759.	1.53	7.67	265.10	
3.06	23.25	5.69	12588.	5.04	11150.	0.00	0.	10.74	23739.	1.53	7.67	265.10	
3.08	23.35	5.70	24101.	4.20	17763.	0.00	0.	9.90	41863.	2.04	7.16	507.10	BARGE CANAL
3.09	23.45	5.69	24077.	4.20	17747.	0.00	0.	9.89	41823.	2.05	7.15	507.10	
3.10	23.55	5.69	24053.	4.19	17731.	0.00	0.	9.88	41784.	2.05	7.15	507.10	
3.12	23.65	5.68	24029.	4.19	17715.	0.00	0.	9.87	41744.	2.05	7.15	507.10	
3.13	23.75	5.68	24005.	4.18	17699.	0.00	0.	9.86	41705.	2.06	7.14	507.10	
3.14	23.85	5.67	23982.	4.18	17683.	0.00	0.	9.85	41665.	2.06	7.14	507.10	
3.16	23.95	5.66	23958.	4.18	17668.	0.00	0.	9.84	41626.	2.06	7.14	507.10	
3.17	24.05	5.66	23946.	4.18	17660.	0.00	0.	9.84	41606.	2.07	7.13	507.10	BROOKS SW
3.19	24.15	5.66	23923.	4.17	17645.	0.00	0.	9.83	41568.	2.07	7.13	507.10	
3.20	24.25	5.65	23900.	4.17	17629.	0.00	0.	9.82	41529.	2.07	7.13	507.10	
3.21	24.35	5.65	23877.	4.16	17614.	0.00	0.	9.81	41491.	2.08	7.12	507.10	
3.23	24.45	5.64	23866.	4.16	17607.	0.00	0.	9.81	41473.	2.08	7.12	507.10	PLYMOUTH SW
3.24	24.55	5.64	23844.	4.16	17592.	0.00	0.	9.80	41436.	2.08	7.12	507.10	
3.25	24.65	5.63	23822.	4.16	17577.	0.00	0.	9.79	41399.	2.08	7.12	507.10	
3.27	24.75	5.63	23799.	4.15	17562.	0.00	0.	9.78	41362.	2.09	7.11	507.10	
3.28	24.85	5.62	23777.	4.15	17547.	0.00	0.	9.77	41325.	2.09	7.11	507.10	
3.29	24.95	5.62	23755.	4.15	17533.	0.00	0.	9.76	41288.	2.09	7.11	507.10	
3.31	25.05	5.61	23733.	4.14	17518.	0.00	0.	9.75	41251.	2.09	7.11	507.10	
3.32	25.15	5.61	23711.	4.14	17503.	0.00	0.	9.75	41214.	2.10	7.10	507.10	
3.33	25.25	5.60	23689.	4.14	17489.	0.00	0.	9.74	41177.	2.10	7.10	507.10	
3.35	25.35	5.60	23667.	4.13	17474.	0.00	0.	9.73	41140.	2.10	7.10	507.10	

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                                    STREAM ASSIMILATION CAPACITY                                    PAGE   7

                                    PRESENT LOADINGS - AVG.COND                          REPORT PRINTED  2/ 4/74

                    ------------------------ OXYGEN DEMAND ------------------------ ---- OXYGEN ---
                    CARBONACEOUS     NITROGENEOUS       BENTHIC           TOTAL      DEFICIT  LEVEL    FLOW
  TIME    DIST.    MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS    MG/L    MG/L     MGD
 -------  -------  -------------   ---------------  ----------------  ---------------  ------- -------  -------
   3.36    25.45    5.59  23644.    4.13  17459.    0.00       0.     9.72  41104.    2.11    7.09   507.10
   3.37    25.55    5.59  23622.    4.12  17444.    0.00       0.     9.71  41067.    2.11    7.09   507.10
   3.38    25.65    5.58  23600.    4.12  17430.    0.00       0.     9.70  41030.    2.11    7.09   507.10
   3.40    25.75    5.58  23578.    4.12  17415.    0.00       0.     9.69  40994.    2.11    7.09   507.10
   3.41    25.85    5.57  23556.    4.11  17401.    0.00       0.     9.68  40957.    2.12    7.08   507.10
   3.42    25.95    5.56  23534.    4.11  17386.    0.00       0.     9.68  40920.    2.12    7.08   507.10
   3.44    26.05    5.56  23512.    4.11  17371.    0.00       0.     9.67  40884.    2.12    7.08   507.10
   3.45    26.15    5.55  23491.    4.10  17357.    0.00       0.     9.66  40847.    2.13    7.07   507.10
   3.46    26.25    5.55  23469.    4.10  17342.    0.00       0.     9.65  40811.    2.13    7.07   507.10
   3.48    26.35    5.54  23447.    4.10  17328.    0.00       0.     9.64  40774.    2.13    7.07   507.10
   3.49    26.45    5.61  23811.    4.21  17862.    0.00       0.     9.81  41673.    2.15    7.05   509.10  COURT SW
   3.50    26.55    5.60  23788.    4.20  17847.    0.00       0.     9.81  41636.    2.16    7.04   509.10
   3.52    26.65    5.60  23766.    4.20  17832.    0.00       0.     9.80  41599.    2.16    7.04   509.10
   3.53    26.75    5.59  23744.    4.20  17817.    0.00       0.     9.79  41561.    2.16    7.04   509.10
   3.54    26.85    5.59  23722.    4.19  17802.    0.00       0.     9.78  41524.    2.16    7.04   509.10
   3.56    26.95    5.58  23700.    4.19  17787.    0.00       0.     9.77  41487.    2.17    7.03   509.10
   3.57    27.05    5.58  23678.    4.19  17772.    0.00       0.     9.76  41450.    2.17    7.03   509.10
   3.58    27.15    5.57  23667.    4.18  17765.    0.00       0.     9.76  41432.    2.17    7.03   509.10  CENTRAL SW
   3.59    27.25    5.57  23645.    4.18  17750.    0.00       0.     9.75  41395.    2.17    7.03   509.10
   3.61    27.35    5.56  23623.    4.18  17735.    0.00       0.     9.74  41358.    2.18    7.02   509.10
   3.62    27.45    5.56  23601.    4.17  17720.    0.00       0.     9.73  41321.    2.18    7.02   509.10
   3.63    27.55    5.56  23590.    4.17  17713.    0.00       0.     9.73  41303.    2.18    7.02   509.10  MILL-FACTORY
   3.65    27.65    5.55  23568.    4.17  17698.    0.00       0.     9.72  41266.    2.18    7.02   509.10
   3.66    27.75    5.55  23567.    4.17  17701.    0.00       0.     9.72  41268.    2.18    7.02   509.20  BAUSCH & LOMB
   3.67    27.85    5.54  23545.    4.16  17686.    0.00       0.     9.71  41232.    2.19    7.01   509.20
   3.69    27.95    5.54  23523.    4.16  17671.    0.00       0.     9.70  41195.    2.19    7.01   509.20
   3.70    28.05    5.53  23501.    4.16  17657.    0.00       0.     9.69  41158.    2.19    7.01   509.20
   3.71    28.15    5.53  23480.    4.15  17642.    0.00       0.     9.68  41121.    2.19    7.01   509.20
   3.73    28.25    5.53  23469.    4.15  17634.    0.00       0.     9.68  41103.    2.20    7.00   509.20  CARTHAGE SW
   3.74    28.35    5.52  23447.    4.15  17620.    0.00       0.     9.67  41066.    2.20    7.00   509.20
   3.75    28.45    5.52  23425.    4.15  17605.    0.00       0.     9.66  41030.    2.20    7.00   509.20
   3.77    28.55    5.51  23403.    4.14  17590.    0.00       0.     9.65  40993.    2.20    7.00   509.20
   3.78    28.65    5.51  23381.    4.14  17575.    0.00       0.     9.64  40956.    2.21    6.99   509.20
   3.79    28.75    5.50  23371.    4.14  17568.    0.00       0.     9.64  40938.    2.21    6.99   509.20  LEXINGTON SW
   3.80    28.85    5.50  23349.    4.13  17553.    0.00       0.     9.63  40902.    2.21    6.99   509.20
   3.82    28.95    5.49  23327.    4.13  17538.    0.00       0.     9.62  40865.    2.21    6.99   509.20
   3.83    29.05    5.49  23305.    4.13  17524.    0.00       0.     9.61  40829.    2.21    6.99   509.20
   3.84    29.15    5.48  23283.    4.12  17509.    0.00       0.     9.61  40792.    2.22    6.98   509.20
   3.86    29.25    6.10  26015.    4.24  18095.    0.00       0.    10.35  44110.    2.24    6.96   511.20  SETH GREEN SW
   3.87    29.35    6.10  25991.    4.24  18080.    0.00       0.    10.34  44071.    2.24    6.96   511.20
   3.88    29.45    6.09  25967.    4.24  18065.    0.00       0.    10.33  44031.    2.24    6.96   511.20
   3.90    29.55    6.08  25942.    4.23  18050.    0.00       0.    10.32  43992.    2.25    6.95   511.20
   3.91    29.65    6.08  25918.    4.23  18035.    0.00       0.    10.31  43953.    2.25    6.95   511.20
   3.92    29.75    6.07  25894.    4.23  18019.    0.00       0.    10.30  43913.    2.25    6.95   511.20
   3.94    29.85    6.07  25870.    4.22  18004.    0.00       0.    10.29  43874.    2.25    6.95   511.20
   3.95    29.95    7.12  33114.    4.23  18135.    0.00       0.    11.95  51248.    2.29    6.91   514.20  MAPLEWOOD SW
   3.96    30.05    7.11  33077.    4.22  18116.    0.00       0.    11.94  51192.    2.29    6.91   514.20
   3.97    30.15    7.10  33040.    4.22  18097.    0.00       0.    11.92  51137.    2.30    6.90   514.20
   3.99    30.25    7.10  33003.    4.22  18078.    0.00       0.    11.91  51081.    2.31    6.89   514.20
   4.00    30.35    7.09  32966.    4.21  18059.    0.00       0.    11.90  51025.    2.32    6.88   514.20
   4.01    30.45    9.10  41133.    6.89  31158.    0.02      78.    16.00  72369.    2.51    6.69   542.20  KODAK STP
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STREAM ASSIMILATION CAPACITY

PRESENT LOADINGS - AVG.COND

REPORT PRINTED 2/ 4/74

TIME	DIST.	OXYGEN DEMAND CARBONACEOUS MG/L	CARBONACEOUS POUNDS	NITROGENEOUS MG/L	NITROGENEOUS POUNDS	BENTHIC MG/L	BENTHIC POUNDS	TOTAL MG/L	TOTAL POUNDS	OXYGEN DEFICIT MG/L	OXYGEN LEVEL MG/L	FLOW MGD	
4.02	30.55	9.01	40742.	6.83	30872.	0.03	156.	15.87	71770.	2.56	6.64	542.20	
4.04	30.65	8.92	40355.	6.76	30589.	0.05	234.	15.74	71178.	2.62	6.58	542.20	
4.05	30.75	8.84	39972.	6.70	30308.	0.07	312.	15.61	70592.	2.67	6.53	542.20	
4.06	30.85	8.76	39593.	6.64	30030.	0.09	389.	15.48	70012.	2.73	6.47	542.20	
4.08	30.95	8.67	39217.	6.58	29754.	0.10	467.	15.36	69439.	2.78	6.42	542.20	
4.09	31.05	8.59	38845.	6.52	29481.	0.12	545.	15.23	68871.	2.83	6.37	542.20	
4.10	31.15	8.51	38476.	6.46	29211.	0.14	623.	15.11	68310.	2.89	6.31	542.20	
4.12	31.25	8.43	38111.	6.40	28943.	0.15	701.	14.98	67754.	2.94	6.26	542.20	
4.13	31.35	8.35	37749.	6.34	28677.	0.17	779.	14.86	67205.	2.99	6.21	542.20	
4.14	31.45	8.27	37390.	6.28	28414.	0.19	857.	14.74	66661.	3.03	6.17	542.20	
4.16	31.55	8.19	37035.	6.23	28153.	0.21	935.	14.62	66123.	3.08	6.12	542.20	
4.17	31.65	8.11	36684.	6.17	27895.	0.22	1012.	14.51	65591.	3.13	6.07	542.20	
4.18	31.75	8.04	36336.	6.11	27639.	0.24	1090.	14.39	65065.	3.17	6.03	542.20	
4.20	31.85	7.96	35991.	6.06	27385.	0.26	1168.	14.27	64544.	3.22	5.98	542.20	
4.21	31.95	7.88	35649.	6.00	27134.	0.28	1246.	14.16	64029.	3.26	5.94	542.20	
4.22	32.05	7.81	35310.	5.95	26885.	0.29	1324.	14.05	63519.	3.31	5.89	542.20	
4.24	32.15	7.73	34975.	5.89	26638.	0.31	1402.	13.94	63015.	3.35	5.85	542.20	
4.25	32.25	7.66	34643.	5.84	26394.	0.33	1480.	13.83	62517.	3.39	5.81	542.20	
4.26	32.35	7.59	34314.	5.78	26151.	0.34	1558.	13.72	62023.	3.43	5.77	542.20	
4.28	32.45	7.52	33989.	5.73	25911.	0.36	1635.	13.61	61535.	3.47	5.73	542.20	
4.29	32.55	7.44	33666.	5.68	25674.	0.38	1713.	13.50	61053.	3.51	5.69	542.20	
4.30	32.65	7.37	33346.	5.63	25438.	0.40	1791.	13.40	60576.	3.55	5.65	542.20	
4.32	32.75	7.30	33030.	5.57	25205.	0.41	1869.	13.29	60103.	3.59	5.61	542.20	
4.33	32.85	7.23	32716.	5.52	24973.	0.43	1947.	13.19	59636.	3.62	5.58	542.20	
4.34	32.95	7.17	32406.	5.47	24744.	0.45	2025.	13.09	59174.	3.66	5.54	542.20	
4.36	33.05	7.10	32098.	5.42	24517.	0.46	2103.	12.99	58718.	3.70	5.50	542.20	
4.37	33.15	7.03	31793.	5.37	24292.	0.48	2181.	12.89	58266.	3.73	5.47	542.20	
4.38	33.25	6.96	31491.	5.32	24069.	0.50	2258.	12.79	57819.	3.76	5.44	542.20	
4.40	33.35	6.90	31192.	5.27	23848.	0.52	2336.	12.69	57377.	3.80	5.40	542.20	
4.41	33.45	6.83	30896.	5.23	23629.	0.53	2414.	12.59	56940.	3.83	5.37	542.20	
4.42	33.55	6.77	30603.	5.18	23413.	0.55	2492.	12.50	56508.	3.86	5.34	542.20	
4.44	33.65	6.70	30312.	5.13	23198.	0.57	2570.	12.40	56080.	3.89	5.31	542.20	
4.45	33.75	6.64	30025.	5.08	22985.	0.59	2648.	12.31	55657.	3.92	5.28	542.20	
4.46	33.85	6.58	29740.	5.04	22774.	0.60	2726.	12.22	55239.	3.95	5.25	542.20	
4.47	33.95	6.51	29457.	4.99	22565.	0.62	2804.	12.12	54826.	3.98	5.22	542.20	
4.49	34.05	6.64	30084.	5.12	23213.	0.01	62.	11.77	53359.	4.02	5.18	543.45	IRON-ST PAUL
4.50	34.15	6.58	29806.	5.07	22980.	0.03	125.	11.67	52911.	4.07	5.13	543.45	
4.51	34.25	6.52	29531.	5.02	22749.	0.04	187.	11.58	52467.	4.12	5.08	543.45	
4.53	34.35	6.46	29258.	4.97	22521.	0.05	249.	11.48	52028.	4.17	5.03	543.45	
4.54	34.45	6.40	28988.	4.92	22294.	0.07	311.	11.38	51594.	4.22	4.98	543.45	
4.55	34.55	6.34	28721.	4.87	22070.	0.08	374.	11.29	51165.	4.26	4.94	543.45	
4.56	34.65	6.28	28456.	4.82	21848.	0.10	436.	11.20	50740.	4.31	4.89	543.45	
4.58	34.75	6.22	28193.	4.77	21629.	0.11	498.	11.10	50320.	4.36	4.84	543.45	

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                STREAM ASSIMILATION CAPACITY                        PAGE   1

                 PRESENT LOADINGS MATCD/10

INPUT CONDITIONS

                 REACH                  START
  REACH NAME    LENGTH  VELOC.   TIME   TIME    FLOW    D.O.    COD     NOD     K1      K2      K3    ESTU.  BENTH.  BOTTOM
                                                                                                      CONST  DEMAND   AREA
--------------  ------  ------  ------  ------  ------  ------  ------  ------  ------  ------  ------  ------  ------  ------
                  0.CC    7.00    0.00            48.50    7.80    3.03    2.21   0.081   0.076   0.209   0.000    0.00    0.00

OXYGEN SATURATION LEVEL =  8.20

 NO INFLOW        0.30    7.00    0.04    0.00    0.00    0.00    0.00    0.00   0.080   0.075   0.208   0.000    0.00    0.00
 AVON STP         7.70    7.00    1.10    0.04    1.00    4.00   60.00   60.00   0.080   0.075   0.208   0.000    0.00    0.00
 HONEOYE CREEK    4.30    7.17    0.59    1.14    0.18    6.20    6.30    0.95   0.080   0.075   0.208   0.000    0.00    0.00
 OATKA CREEK      2.20    7.00    0.31    1.74   12.20    9.50    6.92    3.07   0.080   0.075   0.318   0.000    0.00    0.00
 SCOTTSVILLE      6.00    7.00    0.85    2.05    0.00    4.00   87.50   87.50   0.080   0.075   0.318   0.000    0.00    0.00
 BLACK CREEK      0.50    7.10    0.07    2.91    0.57    6.20    3.82    6.18   0.067   0.060   0.208   0.000    0.00    0.00
 GCO STP          2.30    7.10    0.32    2.98   11.90    4.00   74.00   74.00   0.067   0.060   0.208   0.000    0.00    0.00
 BARGE CANAL      0.70    7.34    0.09    3.30  242.00    4.60    5.68    4.32   0.070   0.063   0.205   0.000    0.00    0.00
 BROOKS SW        0.40    7.34    0.05    3.40    0.00    0.00    0.00    0.00   0.070   0.063   0.208   0.000    0.00    0.00
 PLYMOUTH SW      2.00    7.34    0.27    3.45    0.00    0.00    0.00    0.00   0.070   0.063   0.208   0.000    0.00    0.00
 COURT SW         0.75    7.34    0.10    3.73    2.00    2.00   22.47   32.51   0.070   0.063   0.210   0.000    0.00    0.00
 CENTRAL SW       0.40    7.34    0.05    3.83    0.00    0.00    0.00    0.00   0.070   0.063   0.210   0.000    0.00    0.00
 MILL-FACTORY     0.20    7.34    0.02    3.88    0.00    0.00    0.00    0.00   0.070   0.063   0.210   0.000    0.00    0.00
 BAUSCH & LOMB    0.50    7.55    0.06    3.91    0.10    4.00   12.50   12.50   0.070   0.063   0.210   0.000    0.00    0.00
 CARTHAGE SW      0.50    7.55    0.06    3.98    0.00    0.00    0.00    0.00   0.070   0.063   0.210   0.000    0.00    0.00
 LEXINGTON SW     0.50    7.55    0.06    4.04    0.00    0.00    0.00    0.00   0.070   0.063   0.210   0.000    0.00    0.00
 SETH GREEN SW    0.70    7.55    0.09    4.11    2.00    2.00  164.40   35.60   0.070   0.063   0.210   0.000    0.00    0.00
 MAPLEWOOD SW     0.45    7.55    0.05    4.20    3.00    2.00  290.00    5.50   0.090   0.084   0.155   0.000    0.00    0.00
 KODAK STP        3.60    7.22    0.49    4.26   28.00    4.00   35.80   56.70   0.090   0.084   0.120  10.000    0.62    1.00
 IRON-ST PAUL     0.70    7.50    0.09    4.76    1.25    4.00   73.25   73.25   0.085   0.101   0.047  10.000    0.11    0.74
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                                         STREAM ASSIMILATION CAPACITY                                                  PAGE  2

                                         PRESENT LOADINGS MATCD/10                                     REPORT PRINTED  2/ 4/74

                     ------------------------ OXYGEN DEMAND ------------------------------------ ---- OXYGEN ---
                      CARBONACEOUS     NITROGENEOUS         BENTHIC              TOTAL       DEFICIT   LEVEL     FLOW
   TIME     DIST.    MG/L   POUNDS    MG/L   POUNDS     MG/L   POUNDS     MG/L   POUNDS     MG/L     MG/L      MGD
  -------  -------  ------- -------  ------- -------  ------- -------  ------- -------  -------  -------  -------
   0.00     0.00     3.03   1226.     2.21    894.     0.00      0.     5.24   2120.     0.40     7.80    48.50   NO INFLOW
   0.01     0.05     3.03   1225.     2.21    893.     0.00      0.     5.24   2118.     0.40     7.80    48.50
   0.02     0.15     3.02   1223.     2.21    892.     0.00      0.     5.23   2116.     0.41     7.79    48.50
   0.04     0.25     3.02   1222.     2.20    891.     0.00      0.     5.23   2114.     0.41     7.79    48.50
   0.05     0.35     4.17   1721.     3.37   1391.     0.00      0.     7.54   3113.     0.49     7.71    49.50   AVON STP
   0.06     0.45     4.17   1719.     3.37   1390.     0.00      0.     7.53   3109.     0.50     7.70    49.50
   0.08     0.55     4.16   1717.     3.36   1388.     0.00      0.     7.52   3106.     0.51     7.69    49.50
   0.09     0.65     4.16   1716.     3.36   1387.     0.00      0.     7.51   3102.     0.51     7.69    49.50
   0.11     0.75     4.15   1714.     3.36   1385.     0.00      0.     7.51   3099.     0.52     7.68    49.50
   0.12     0.85     4.15   1712.     3.35   1384.     0.00      0.     7.50   3095.     0.53     7.67    49.50
   0.14     1.00     4.14   1709.     3.35   1381.     0.00      0.     7.48   3090.     0.54     7.66    49.50
   0.16     1.10     4.13   1707.     3.34   1380.     0.00      0.     7.48   3086.     0.54     7.66    49.50
   0.17     1.20     4.13   1705.     3.34   1378.     0.00      0.     7.47   3083.     0.55     7.65    49.50
   0.19     1.30     4.12   1703.     3.34   1377.     0.00      0.     7.46   3080.     0.56     7.64    49.50
   0.20     1.40     4.12   1701.     3.33   1375.     0.00      0.     7.45   3076.     0.56     7.64    49.50
   0.21     1.50     4.11   1699.     3.33   1374.     0.00      0.     7.44   3073.     0.57     7.63    49.50
   0.23     1.60     4.11   1697.     3.32   1372.     0.00      0.     7.43   3069.     0.58     7.62    49.50
   0.24     1.70     4.11   1695.     3.32   1371.     0.00      0.     7.43   3066.     0.58     7.62    49.50
   0.26     1.80     4.10   1693.     3.32   1369.     0.00      0.     7.42   3062.     0.59     7.61    49.50
   0.27     1.90     4.10   1691.     3.31   1368.     0.00      0.     7.41   3059.     0.60     7.60    49.50
   0.29     2.00     4.09   1689.     3.31   1366.     0.00      0.     7.40   3055.     0.60     7.60    49.50
   0.30     2.10     4.09   1687.     3.31   1365.     0.00      0.     7.39   3052.     0.61     7.59    49.50
   0.31     2.20     4.08   1685.     3.30   1363.     0.00      0.     7.38   3048.     0.62     7.58    49.50
   0.33     2.30     4.08   1683.     3.30   1362.     0.00      0.     7.38   3045.     0.62     7.58    49.50
   0.34     2.40     4.07   1681.     3.30   1361.     0.00      0.     7.37   3042.     0.63     7.57    49.50
   0.36     2.50     4.07   1679.     3.29   1359.     0.00      0.     7.36   3038.     0.64     7.56    49.50
   0.37     2.60     4.06   1677.     3.29   1358.     0.00      0.     7.35   3035.     0.64     7.56    49.50
   0.39     2.70     4.06   1675.     3.28   1356.     0.00      0.     7.34   3031.     0.65     7.55    49.50
   0.40     2.80     4.05   1673.     3.28   1355.     0.00      0.     7.33   3028.     0.65     7.55    49.50
   0.41     2.90     4.05   1671.     3.28   1353.     0.00      0.     7.33   3025.     0.66     7.54    49.50
   0.43     3.00     4.04   1669.     3.27   1352.     0.00      0.     7.32   3021.     0.67     7.53    49.50
   0.44     3.10     4.04   1668.     3.27   1350.     0.00      0.     7.31   3018.     0.67     7.53    49.50
   0.46     3.20     4.03   1666.     3.27   1349.     0.00      0.     7.30   3014.     0.68     7.52    49.50
   0.47     3.30     4.03   1664.     3.26   1347.     0.00      0.     7.29   3011.     0.69     7.51    49.50
   0.49     3.40     4.03   1662.     3.26   1346.     0.00      0.     7.29   3008.     0.69     7.51    49.50
   0.50     3.50     4.02   1660.     3.26   1344.     0.00      0.     7.28   3004.     0.70     7.50    49.50
   0.51     3.60     4.02   1658.     3.25   1343.     0.00      0.     7.27   3001.     0.70     7.50    49.50
   0.53     3.70     4.01   1656.     3.25   1341.     0.00      0.     7.26   2997.     0.71     7.49    49.50
   0.54     3.80     4.01   1654.     3.25   1340.     0.00      0.     7.25   2994.     0.72     7.48    49.50
   0.56     3.90     4.00   1652.     3.24   1339.     0.00      0.     7.24   2991.     0.72     7.48    49.50
   0.57     4.00     4.00   1650.     3.24   1337.     0.00      0.     7.24   2987.     0.73     7.47    49.50
   0.59     4.10     3.99   1648.     3.24   1336.     0.00      0.     7.23   2984.     0.73     7.47    49.50
   0.60     4.20     3.99   1646.     3.23   1334.     0.00      0.     7.22   2981.     0.74     7.46    49.50
   0.61     4.30     3.98   1645.     3.23   1333.     0.00      0.     7.21   2977.     0.75     7.45    49.50
   0.63     4.40     3.98   1643.     3.22   1331.     0.00      0.     7.20   2974.     0.75     7.45    49.50
   0.64     4.50     3.97   1641.     3.22   1330.     0.00      0.     7.20   2971.     0.76     7.44    49.50
   0.66     4.60     3.97   1639.     3.22   1328.     0.00      0.     7.19   2967.     0.76     7.44    49.50
   0.67     4.70     3.97   1637.     3.21   1327.     0.00      0.     7.18   2964.     0.77     7.43    49.50
   0.69     4.80     3.96   1635.     3.21   1326.     0.00      0.     7.17   2961.     0.77     7.43    49.50
   0.70     4.90     3.96   1633.     3.21   1324.     0.00      0.     7.16   2957.     0.78     7.42    49.50
   0.71     5.00     3.95   1631.     3.20   1323.     0.00      0.     7.16   2954.     0.79     7.41    49.50
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                                          STREAM ASSIMILATION CAPACITY                                          PAGE   3

                                          PRESENT LOADINGS MATCD/10                                   REPORT PRINTED  2/ 4/74

                     ----------------------- OXYGEN DEMAND ------------------------ ---- OXYGEN ---
                      CARBONACEOUS    NITROGENEOUS       BENTHIC          TOTAL      DEFICIT  LEVEL    FLOW
   TIME    DIST.     MG/L  POUNDS    MG/L  POUNDS    MG/L  POUNDS    MG/L  POUNDS    MG/L    MG/L     MGD
 ------- -------   ------- -------  ------- -------  ------- ------- ------- -------  ------- -------  -------
    0.73    5.10     3.95   1629.     3.20   1321.     0.00      0.     7.15   2951.    0.79    7.41    49.50
    0.74    5.20     3.94   1628.     3.20   1320.     0.00      0.     7.14   2947.    0.80    7.40    49.50
    0.76    5.30     3.94   1626.     3.19   1318.     0.00      0.     7.13   2944.    0.80    7.40    49.50
    0.77    5.40     3.93   1624.     3.19   1317.     0.00      0.     7.12   2941.    0.81    7.39    49.50
    0.79    5.50     3.93   1622.     3.19   1315.     0.00      0.     7.12   2937.    0.81    7.39    49.50
    0.80    5.60     3.92   1620.     3.18   1314.     0.00      0.     7.11   2934.    0.82    7.38    49.50
    0.81    5.70     3.92   1618.     3.18   1313.     0.00      0.     7.10   2931.    0.82    7.38    49.50
    0.83    5.80     3.92   1616.     3.18   1311.     0.00      0.     7.09   2927.    0.83    7.37    49.50
    0.84    5.90     3.91   1614.     3.17   1310.     0.00      0.     7.08   2924.    0.84    7.36    49.50
    0.86    6.00     3.91   1613.     3.17   1308.     0.00      0.     7.08   2921.    0.84    7.36    49.50
    0.87    6.10     3.90   1611.     3.17   1307.     0.00      0.     7.07   2918.    0.85    7.35    49.50
    0.89    6.20     3.90   1609.     3.16   1306.     0.00      0.     7.06   2914.    0.85    7.35    49.50
    0.90    6.30     3.8[illegible]   1607.     3.16   1304.     0.00      0.     7.05   2911.    0.86    7.34    49.50
    0.91    6.40     3.89   1605.     3.16   1303.     0.00      0.     7.04   2908.    0.86    7.34    49.50
    0.93    6.50     3.88   1603.     3.15   1301.     0.00      0.     7.04   2905.    0.87    7.33    49.50
    0.94    6.60     3.88   1601.     3.15   1300.     0.00      0.     7.03   2901.    0.87    7.33    49.50
    0.96    6.70     3.87   1600.     3.15   1298.     0.00      0.     7.02   2898.    0.88    7.32    49.50
    0.97    6.80     3.87   1598.     3.14   1297.     0.00      0.     7.01   2895.    0.88    7.32    49.50
    0.99    6.90     3.87   1595.     3.14   1296.     0.00      0.     7.00   28[illegible]    0.89    7.31    49.50
    1.00    7.00     3.86   1594.     3.14   1294.     0.00      0.     7.00   2888.    0.89    7.31    49.50
    1.01    7.10     3.86   1592.     3.13   1293.     0.00      0.     6.99   2885.    0.90    7.30    49.50
    1.03    7.20     3.85   1590.     3.13   1291.     0.00      0.     6.98   2882.    0.90    7.30    49.50
    1.04    7.30     3.85   1588.     3.12   1290.     0.00      0.     6.97   2878.    0.91    7.29    49.50
    1.06    7.40     3.84   1587.     3.12   1289.     0.00      0.     6.96   2875.    0.91    7.29    49.50
    1.07    7.50     3.84   1585.     3.12   1287.     0.00      0.     6.96   2872.    0.92    7.28    49.50
    1.09    7.60     3.83   1583.     3.11   1286.     0.00      0.     6.95   2869.    0.92    7.28    49.50
    1.10    7.70     3.83   1581.     3.11   1284.     0.00      0.     6.94   2866.    0.93    7.27    49.50
    1.11    7.80     3.83   1579.     3.11   1283.     0.00      0.     6.93   2862.    0.93    7.27    49.50
    1.13    7.90     3.82   1577.     3.10   1282.     0.00      0.     6.93   2859.    0.94    7.26    49.50
    1.14    8.00     3.83   1586.     3.10   1282.     0.00      0.     6.92   2868.    0.95    7.25    49.68   HONEOYE CREEK
    1.16    8.10     3.82   1584.     3.09   1281.     0.00      0.     6.92   2865.    0.95    7.25    49.68
    1.17    8.20     3.82   1582.     3.09   1280.     0.00      0.     6.91   2862.    0.96    7.24    49.68
    1.18    8.30     3.81   1581.     3.09   1278.     0.00      0.     6.90   2859.    0.96    7.24    49.68
    1.20    8.40     3.81   1579.     3.08   1277.     0.00      0.     6.89   2856.    0.97    7.23    49.68
    1.21    8.50     3.81   1577.     3.08   1276.     0.00      0.     6.89   2853.    0.97    7.23    49.68
    1.23    8.60     3.80   1575.     3.08   1274.     0.00      0.     6.88   2850.    0.97    7.23    49.68
    1.24    8.70     3.80   1574.     3.07   1273.     0.00      0.     6.87   2846.    0.98    7.22    49.68
    1.25    8.80     3.79   1572.     3.07   1272.     0.00      0.     6.86   2843.    0.98    7.22    49.68
    1.27    8.90     3.79   1570.     3.07   1270.     0.00      0.     6.85   2840.    0.99    7.21    49.68
    1.28    9.00     3.78   1568.     3.06   1269.     0.00      0.     6.85   2837.    0.99    7.21    49.68
    1.30    9.10     3.78   1566.     3.06   1268.     0.00      0.     6.84   2834.    1.00    7.20    49.68
    1.31    9.20     3.78   1565.     3.06   1266.     0.00      0.     6.83   2831.    1.00    7.20    49.68
    1.32    9.30     3.77   1563.     3.05   1265.     0.00      0.     6.82   2828.    1.01    7.19    49.68
    1.34    9.40     3.77   1561.     3.05   1264.     0.00      0.     6.82   2825.    1.01    7.19    49.68
    1.35    9.50     3.76   1559.     3.05   1262.     0.00      0.     6.81   2822.    1.02    7.18    49.68
    1.37    9.60     3.76   1558.     3.04   1261.     0.00      0.     6.80   2818.    1.02    7.18    49.68
    1.38    9.70     3.76   1556.     3.04   1259.     0.00      0.     6.79   2815.    1.03    7.17    49.68
    1.39    9.80     3.75   1554.     3.04   1258.     0.00      0.     6.79   2812.    1.03    7.17    49.68
    1.41    9.90     3.75   1552.     3.03   1257.     0.00      0.     6.78   2809.    1.03    7.17    49.68
    1.42   10.00     3.74   1551.     3.03   1255.     0.00      0.     6.77   2806.    1.04    7.16    49.68
    1.44   10.10     3.74   1549.     3.03   1254.     0.00      0.     6.77   2803.    1.04    7.16    49.68
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                                   STREAM ASSIMILATION CAPACITY                                          PAGE   4

                                   PRESENT LOADINGS MATCD/10                                   REPORT PRINTED  2/ 4/74

                   ---------------------- OXYGEN DEMAND ---------------------------- ---- OXYGEN ---
                     CARBONACEOUS     NITROGENEOUS        BENTHIC           TOTAL      DEFICIT   LEVEL     FLOW
  TIME     DIST.    MG/L    POUNDS    MG/L    POUNDS    MG/L    POUNDS    MG/L    POUNDS    MG/L     MG/L     MGD
 -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------  -------
   1.45    10.20     3.73    1547.     3.02    1253.     0.00       0.      6.76    2800.     1.05     7.15    49.68
   1.46    10.30     3.73    1545.     3.02    1252.     0.00       0.      6.75    2797.     1.05     7.15    49.68
   1.48    10.40     3.73    1544.     3.02    1250.     0.00       0.      6.74    2794.     1.06     7.14    49.68
   1.49    10.50     3.72    1542.     3.01    1249.     0.00       0.      6.74    2791.     1.06     7.14    49.68
   1.51    10.60     3.72    1540.     3.01    1248.     0.00       0.      6.73    2788.     1.06     7.14    49.68
   1.52    10.70     3.71    1538.     3.01    1246.     0.00       0.      6.72    2785.     1.07     7.13    49.68
   1.53    10.80     3.71    1537.     3.00    1245.     0.00       0.      6.71    2782.     1.07     7.13    49.68
   1.55    10.90     3.70    1535.     3.00    1244.     0.00       0.      6.71    2778.     1.08     7.12    49.68
   1.56    11.00     3.70    1533.     3.00    1242.     0.00       0.      6.70    2775.     1.08     7.12    49.68
   1.58    11.10     3.70    1531.     3.00    1241.     0.00       0.      6.69    2772.     1.09     7.11    49.68
   1.59    11.20     3.69    1530.     2.99    1240.     0.00       0.      6.68    2769.     1.09     7.11    49.68
   1.60    11.30     3.6     1528.     2.99    1238.     0.00       0.      6.68    2766.     1.09     7.11    49.68
   1.62    11.40     3.6     1526.     2.99    1237.     0.00       0.      6.67    2763.     1.10     7.10    49.68
   1.63    11.50     3.68    1525.     2.98    1236.     0.00       0.      6.66    2760.     1.10     7.10    49.68
   1.64    11.60     3.68    1523.     2.98    1234.     0.00       0.      6.65    2757.     1.11     7.09    49.68
   1.66    11.70     3.67    1521.     2.98    1233.     0.00       0.      6.65    2754.     1.11     7.09    49.68
   1.67    11.80     3.67    1519.     2.97    1232.     0.00       0.      6.64    2751.     1.11     7.09    49.68
   1.69    11.90     3.66    1518.     2.97    1230.     0.00       0.      6.63    2748.     1.12     7.08    49.68
   1.70    12.00     3.66    1516.     2.97    1229.     0.00       0.      6.63    2745.     1.12     7.08    49.68
   1.71    12.10     3.65    1514.     2.96    1228.     0.00       0.      6.62    2742.     1.13     7.07    49.68
   1.73    12.20     3.65    1513.     2.96    1227.     0.00       0.      6.61    2739.     1.13     7.07    49.68
   1.74    12.30     4.29    2216.     2.98    1538.     0.00       0.      7.27    3754.     0.65     7.55    61.88  OATKA CREEK
   1.76    12.40     4.29    2213.     2.98    1537.     0.00       0.      7.27    3750.     0.66     7.54    61.88
   1.77    12.50     4.28    2211.     2.97    1535.     0.00       0.      7.26    3746.     0.66     7.54    61.88
   1.79    12.60     4.28    2208.     2.97    1533.     0.00       0.      7.25    3741.     0.67     7.53    61.88
   1.80    12.70     4.27    2206.     2.97    1532.     0.00       0.      7.24    3737.     0.67     7.53    61.88
   1.81    12.80     4.27    2203.     2.96    1530.     0.00       0.      7.23    3733.     0.68     7.52    61.88
   1.83    12.90     4.26    2200.     2.96    1528.     0.00       0.      7.23    3729.     0.68     7.52    61.88
   1.84    13.00     4.26    2198.     2.96    1527.     0.00       0.      7.22    3725.     0.69     7.51    61.88
   1.86    13.10     4.25    2195.     2.95    1525.     0.00       0.      7.21    3720.     0.69     7.51    61.88
   1.87    13.20     4.25    2193.     2.95    1523.     0.00       0.      7.20    3716.     0.70     7.50    61.88
   1.89    13.30     4.24    2190.     2.95    1522.     0.00       0.      7.19    3712.     0.70     7.50    61.88
   1.90    13.40     4.24    2188.     2.95    1520.     0.00       0.      7.18    3708.     0.71     7.49    61.88
   1.91    13.50     4.23    2185.     2.94    1518.     0.00       0.      7.18    3704.     0.71     7.49    61.88
   1.93    13.60     4.23    2183.     2.94    1517.     0.00       0.      7.17    3699.     0.72     7.48    61.88
   1.94    13.70     4.22    2180.     2.94    1515.     0.00       0.      7.16    3695.     0.72     7.48    61.88
   1.96    13.80     4.22    2178.     2.93    1513.     0.00       0.      7.15    3691.     0.73     7.47    61.88
   1.97    13.90     4.21    2175.     2.93    1512.     0.00       0.      7.14    3687.     0.73     7.47    61.88
   1.99    14.00     4.21    2173.     2.93    1510.     0.00       0.      7.14    3683.     0.74     7.46    61.88
   2.00    14.10     4.20    2170.     2.92    1509.     0.00       0.      7.13    3679.     0.74     7.46    61.88
   2.01    14.20     4.20    2168.     2.92    1507.     0.00       0.      7.12    3674.     0.75     7.45    61.88
   2.03    14.30     4.20    2165.     2.92    1505.     0.00       0.      7.11    3670.     0.75     7.45    61.88
   2.04    14.40     4.19    2163.     2.91    1504.     0.00       0.      7.10    3666.     0.76     7.44    61.88
   2.06    14.50     4.20    2169.     2.93    1510.     0.00       0.      7.13    3679.     0.76     7.44    61.89  SCOTTSVILLE
   2.07    14.60     4.20    2166.     2.92    1508.     0.00       0.      7.12    3675.     0.76     7.44    61.89
   2.09    14.70     4.19    2164.     2.92    1507.     0.00       0.      7.11    3670.     0.77     7.43    61.89
   2.10    14.80     4.19    2161.     2.92    1505.     0.00       0.      7.10    3666.     0.77     7.43    61.89
   2.11    14.90     4.18    2159.     2.91    1504.     0.00       0.      7.09    3662.     0.78     7.42    61.89
   2.13    15.00     4.18    2156.     2.91    1502.     0.00       0.      7.09    3658.     0.78     7.42    61.89
   2.14    15.10     4.17    2154.     2.91    1500.     0.00       0.      7.08    3654.     0.78     7.42    61.89
   2.16    15.20     4.17    2151.     2.90    1499.     0.00       0.      7.07    3650.     0.79     7.41    61.89
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                                            STREAM ASSIMILATION CAPACITY                                   PAGE   5

                                            PRESENT LOADINGS MATCD/10                           REPORT PRINTED  2/ 4/74

                   ---- ----------------------- OXYGEN DEMAND ------------------------------  ---- OXYGEN ---
                       CARBONACEOUS      NITROGENEOUS          BENTHIC             TOTAL       DEFICIT  LEVEL     FLOW
  TIME     DIST.     MG/L   POUNDS      MG/L    POUNDS     MG/L    POUNDS      MG/L   POUNDS    MG/L    MG/L      MGD
 -------  -------  ---- --  -------  -------  -------  -------  -------   -------  -------  -------  -------  -------
   2.17    15.30    4.16   2149.      2.90    1497.     0.00       0.      7.06    3646.     0.79     7.41    61.89
   2.19    15.40    4.16   2146.      2.90    1495.     0.00       0.      7.06    3642.     0.80     7.40    61.89
   2.20    15.50    4.15   2144.      2.89    1494.     0.00       0.      7.05    3637.     0.80     7.40    61.89
   2.21    15.60    4.15   2141.      2.89    1492.     0.00       0.      7.04    3633.     0.81     7.39    61.89
   2.23    15.70    4.14   2139.      2.89    1491.     0.00       0.      7.03    3629.     0.81     7.39    61.89
   2.24    15.80    4.14   2136.      2.88    1489.     0.00       0.      7.02    3625.     0.82     7.38    61.89
   2.26    15.90    4.13   2134.      2.88    1487.     0.00       0.      7.02    3621.     0.82     7.38    61.89
   2.27    16.00    4.13   2131.      2.88    1486.     0.00       0.      7.01    3617.     0.82     7.38    61.89
   2.29    16.10    4.12   2129.      2.88    1484.     0.00       0.      7.00    3613.     0.83     7.37    61.89
   2.30    16.20    4.12   2126.      2.87    1482.     0.00       0.      6.99    3609.     0.83     7.37    61.89
   2.31    16.30    4.11   2124.      2.87    1481.     0.00       0.      6.98    3605.     0.84     7.36    61.89
   2.33    16.40    4.11   2121.      2.87    1479.     0.00       0.      6.98    3601.     0.84     7.36    61.89
   2.34    16.50    4.11   2119.      2.86    1478.     0.00       0.      6.97    3597.     0.84     7.36    61.89
   2.36    16.60    4.10   2117.      2.86    1476.     0.00       0.      6.96    3593.     0.85     7.35    61.89
   2.37    16.70    4.10   2114.      2.86    1474.     0.00       0.      6.95    3589.     0.85     7.35    61.89
   2.39    16.80    4.09   2112.      2.85    1473.     0.00       0.      6.94    3585.     0.86     7.34    61.89
   2.40    16.90    4.09   2109.      2.85    1471.     0.00       0.      6.94    3580.     0.86     7.34    61.89
   2.41    17.00    4.08   2107.      2.85    1470.     0.00       0.      6.93    3576.     0.86     7.34    61.89
   2.43    17.10    4.08   2104.      2.84    1468.     0.00       0.      6.92    3572.     0.87     7.33    61.89
   2.44    17.20    4.07   2102.      2.84    1466.     0.00       0.      6.91    3568.     0.87     7.33    61.89
   2.46    17.30    4.07   2099.      2.84    1465.     0.00       0.      6.91    3564.     0.87     7.33    61.89
   2.47    17.40    4.06   2097.      2.83    1463.     0.00       0.      6.90    3560.     0.88     7.32    61.89
   2.49    17.50    4.06   2095.      2.83    1462.     0.00       0.      6.89    3556.     0.88     7.32    61.89
   2.50    17.60    4.05   2092.      2.83    1460.     0.00       0.      6.88    3552.     0.89     7.31    61.89
   2.51    17.70    4.05   2090.      2.83    1459.     0.00       0.      6.87    3548.     0.89     7.31    61.89
   2.53    17.80    4.04   2087.      2.82    1457.     0.00       0.      6.87    3544.     0.89     7.31    61.89
   2.54    17.90    4.04   2085.      2.82    1455.     0.00       0.      6.86    3540.     0.90     7.30    61.89
   2.56    18.00    4.03   2083.      2.82    1454.     0.00       0.      6.85    3536.     0.90     7.30    61.89
   2.57    18.10    4.03   2080.      2.81    1452.     0.00       0.      6.84    3532.     0.90     7.30    61.89
   2.59    18.20    4.03   2078.      2.81    1451.     0.00       0.      6.84    3528.     0.90     7.30    61.89
   2.60    18.30    4.02   2075.      2.81    1449.     0.00       0.      6.83    3524.     0.91     7.29    61.89
   2.61    18.40    4.02   2073.      2.80    1447.     0.00       0.      6.82    3520.     0.91     7.29    61.89
   2.63    18.50    4.01   2071.      2.80    1446.     0.00       0.      6.81    3516.     0.92     7.28    61.89
   2.64    18.60    4.01   2068.      2.80    1444.     0.00       0.      6.80    3512.     0.92     7.28    61.89
   2.66    18.70    4.00   2066.      2.80    1443.     0.00       0.      6.80    3509.     0.92     7.28    61.89
   2.67    18.80    4.00   2063.      2.79    1441.     0.00       0.      6.79    3505.     0.93     7.27    61.89
   2.69    18.90    3.99   2061.      2.79    1440.     0.00       0.      6.78    3501.     0.93     7.27    61.89
   2.70    19.00    3.99   2059.      2.79    1438.     0.00       0.      6.77    3497.     0.93     7.27    61.89
   2.71    19.10    3.98   2056.      2.78    1437.     0.00       0.      6.77    3493.     0.94     7.26    61.89
   2.73    19.20    3.98   2054.      2.78    1435.     0.00       0.      6.76    3489.     0.94     7.26    61.89
   2.74    19.30    3.97   2051.      2.78    1433.     0.00       0.      6.75    3485.     0.94     7.26    61.89
   2.76    19.40    3.97   2049.      2.77    1432.     0.00       0.      6.74    3481.     0.95     7.25    61.89
   2.77    19.50    3.97   2047.      2.77    1430.     0.00       0.      6.74    3477.     0.95     7.25    61.89
   2.79    19.60    3.96   2044.      2.77    1429.     0.00       0.      6.73    3473.     0.95     7.25    61.89
   2.80    19.70    3.96   2042.      2.77    1427.     0.00       0.      6.72    3469.     0.96     7.24    61.89
   2.81    19.80    3.95   2040.      2.76    1426.     0.00       0.      6.71    3465.     0.96     7.24    61.89
   2.83    19.90    3.95   2037.      2.76    1424.     0.00       0.      6.71    3461.     0.96     7.24    61.89
   2.84    20.00    3.94   2035.      2.76    1423.     0.00       0.      6.70    3457.     0.97     7.23    61.89
   2.86    20.10    3.94   2033.      2.75    1421.     0.00       0.      6.69    3454.     0.97     7.23    61.89
   2.87    20.20    3.93   2030.      2.75    1419.     0.00       0.      6.68    3450.     0.97     7.23    61.89
   2.89    20.30    3.93   2028.      2.75    1418.     0.00       0.      6.68    3446.     0.98     7.22    61.89
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                                      STREAM ASSIMILATION CAPACITY                                         PAGE   6

                                      PRESENT LOADINGS MATCD/10                                   REPORT PRINTED  2/ 4/74

                   ---------------------- OXYGEN DEMAND ----------------------------- ---- OXYGEN ---
                    CARBONACEOUS    NITROGENEOUS       BENTHIC           TOTAL         DEFICIT  LEVEL     FLOW
  TIME    DIST.    MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS     MG/L    MG/L      MGD
 -------  -------  ------- -------  ------- -------  ------- -------  ------- -------  ------- -------  -------
   2.90    20.40     3.92   2026.     2.74   1416.     0.00      0.     6.67   3442.     0.98    7.22    61.89
   2.91    20.50     3.92   2043.     2.77   1445.     0.00      0.     6.69   3488.     0.99    7.21    62.46  BLACK CREEK
   2.93    20.60     3.92   2041.     2.77   1444.     0.00      0.     6.69   3484.     0.99    7.21    62.46
   2.94    20.70     3.91   2039.     2.77   1443.     0.00      0.     6.68   3481.     1.00    7.20    62.46
   2.96    20.80     3.91   2037.     2.77   1441.     0.00      0.     6.68   3478.     1.00    7.20    62.46
   2.97    20.90     3.91   2035.     2.76   1440.     0.00      0.     6.67   3475.     1.00    7.20    62.46
   2.98    21.00    15.12   9378.    14.16   8784.     0.00      0.    29.29  18162.     1.52    6.68    74.36  GCD STP
   3.00    21.10    15.11   9369.    14.15   8776.     0.00      0.    29.26  18145.     1.54    6.66    74.36
   3.01    21.20    15.09   9360.    14.14   8769.     0.00      0.    29.23  18129.     1.56    6.64    74.36
   3.03    21.30    15.08   9352.    14.13   8761.     0.00      0.    29.21  18113.     1.58    6.62    74.36
   3.04    21.40    15.07   9343.    14.11   8754.     0.00      0.    29.18  18096.     1.60    6.60    74.36
   3.05    21.50    15.05   9334.    14.10   8746.     0.00      0.    29.15  18080.     1.63    6.57    74.36
   3.07    21.60    15.04   9325.    14.09   8739.     0.00      0.    29.13  18064.     1.65    6.55    74.36
   3.08    21.70    15.02   9316.    14.08   8731.     0.00      0.    29.10  18047.     1.67    6.53    74.36
   3.10    21.80    15.01   9308.    14.07   8724.     0.00      0.    29.07  18031.     1.69    6.51    74.36
   3.11    21.90    14.99   9299.    14.05   8716.     0.00      0.    29.05  18015.     1.71    6.49    74.36
   3.13    22.00    14.98   9290.    14.04   8709.     0.00      0.    29.02  17999.     1.73    6.47    74.36
   3.14    22.10    14.97   9281.    14.03   8701.     0.00      0.    29.00  17982.     1.75    6.45    74.36
   3.15    22.20    14.95   9273.    14.02   8694.     0.00      0.    28.97  17966.     1.77    6.43    74.36
   3.17    22.30    14.94   9264.    14.01   8686.     0.00      0.    28.94  17950.     1.79    6.41    74.36
   3.18    22.40    14.92   9255.    13.99   8679.     0.00      0.    28.92  17934.     1.82    6.38    74.36
   3.20    22.50    14.91   9246.    13.98   8671.     0.00      0.    28.89  17917.     1.84    6.36    74.36
   3.21    22.60    14.90   9238.    13.97   8664.     0.00      0.    28.87  17901.     1.86    6.34    74.36
   3.22    22.70    14.88   9229.    13.96   8656.     0.00      0.    28.84  17885.     1.88    6.32    74.36
   3.24    22.80    14.87   9220.    13.95   8649.     0.00      0.    28.81  17869.     1.90    6.30    74.36
   3.25    22.90    14.85   9211.    13.93   8641.     0.00      0.    28.79  17853.     1.92    6.28    74.36
   3.27    23.00    14.84   9203.    13.92   8634.     0.00      0.    28.76  17837.     1.94    6.26    74.36
   3.28    23.10    14.83   9194.    13.91   8627.     0.00      0.    28.74  17821.     1.96    6.24    74.36
   3.29    23.20    14.81   9185.    13.90   8619.     0.00      0.    28.71  17805.     1.98    6.22    74.36
   3.31    23.30     7.82  20645.     6.57  17335.     0.00      0.    14.39  37980.     3.22    4.98   316.36  BARGE CANAL
   3.32    23.40     7.82  20625.     6.56  17319.     0.00      0.    14.38  37945.     3.23    4.97   316.36
   3.34    23.50     7.81  20605.     6.56  17304.     0.00      0.    14.37  37910.     3.23    4.97   316.36
   3.35    23.60     7.80  20585.     6.55  17289.     0.00      0.    14.35  37875.     3.23    4.97   316.36
   3.36    23.70     7.79  20565.     6.55  17274.     0.00      0.    14.34  37840.     3.24    4.96   316.36
   3.38    23.80     7.79  20545.     6.54  17259.     0.00      0.    14.33  37805.     3.24    4.96   316.36
   3.39    23.90     7. 8  20526.     6.54  17244.     0.00      0.    14.32  37770.     3.25    4.95   316.36
   3.40    24.00     7.78  20516.     6.53  17237.     0.00      0.    14.31  37752.     3.25    4.95   316.36  BROOKS SW
   3.42    24.10     7.77  20496.     6.53  17222.     0.00      0.    14.30  37718.     3.25    4.95   316.36
   3.43    24.20     7.76  20476.     6.52  17207.     0.00      0.    14.28  37683.     3.26    4.94   316.36
   3.44    24.30     7.75  20456.     6.52  17192.     0.00      0.    14.27  37648.     3.26    4.94   316.36
   3.46    24.40     7.75  20447.     6.51  17184.     0.00      0.    14.26  37631.     3.26    4.94   316.36  PLYMOUTH SW
   3.47    24.50     7.74  20427.     6.51  17169.     0.00      0.    14.25  37596.     3.27    4.93   316.36
   3.49    24.60     7.73  20407.     6.50  17154.     0.00      0.    14.24  37561.     3.27    4.93   316.36
   3.50    24.70     7.73  20387.     6.50  17139.     0.00      0.    14.22  37527.     3.27    4.93   316.36
   3.51    24.80     7.72  20368.     6.49  17124.     0.00      0.    14.21  37492.     3.28    4.92   316.36
   3.53    24.90     7.71  20348.     6.48  17110.     0.00      0.    14.20  37457.     3.28    4.92   316.36
   3.54    25.00     7.70  20328.     6.48  17095.     0.00      0.    14.18  37423.     3.28    4.92   316.36
   3.55    25.10     7.73  20309.     6.47  17080.     0.00      0.    14.17  37388.     3.29    4.91   316.36
   3.57    25.20     7.69  20289.     6.47  17065.     0.00      0.    14.16  37354.     3.29    4.91   316.36
   3.58    25.30     7.69  20269.     6.46  17050.     0.00      0.    14.14  37319.     3.30    4.90   316.36
   3.59    25.40     7.67  20250.     6.46  17035.     0.00      0.    14.13  37285.     3.30    4.90   316.36
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                                      STREAM ASSIMILATION CAPACITY                                        PAGE    7

                                      PRESENT LOADINGS MATCD/10                                  REPORT PRINTED  2/ 4/74

                      ----------------------- OXYGEN DEMAND ------------------------ ---- OXYGEN ---
                      CARBONACEOUS   NITROGENEOUS       BENTHIC           TOTAL       DEFICIT  LEVEL     FLOW
  TIME     DIST.     MG/L  POUNDS    MG/L  POUNDS    MG/L  POUNDS     MG/L  POUNDS     MG/L    MG/L      MGD
 -------  -------  ------- -------  ------- -------  ------- -------  ------- -------  ------- -------  -------
   3.61    25.50     7.67  20230.     6.45  17020.     0.00      0.     14.12  37250.     3.30    4.90   316.36
   3.62    25.60     7.66  20211.     6.45  17005.     0.00      0.     14.11  37216.     3.31    4.89   316.36
   3.64    25.70     7.65  20191.     6.44  16991.     0.00      0.     14.09  37182.     3.31    4.89   316.36
   3.65    25.80     7.65  20172.     6.43  16976.     0.00      0.     14.08  37147.     3.31    4.89   316.36
   3.66    25.90     7.64  20152.     6.43  16961.     0.00      0.     14.07  37113.     3.32    4.88   316.36
   3.68    26.00     7.63  20133.     6.42  16946.     0.00      0.     14.05  37079.     3.32    4.88   316.36
   3.69    26.10     7.62  20113.     6.42  16931.     0.00      0.     14.04  37045.     3.32    4.88   316.36
   3.70    26.20     7.62  20094.     6.41  16917.     0.00      0.     14.03  37010.     3.33    4.87   316.36
   3.72    26.30     7.61  20074.     6.41  16902.     0.00      0.     14.01  36976.     3.33    4.87   316.36
   3.73    26.40     7.70  20439.     6.57  17437.     0.00      0.     14.27  37876.     3.35    4.85   318.36  COURT SW
   3.74    26.50     7.69  20420.     6.56  17422.     0.00      0.     14.25  37842.     3.35    4.85   318.36
   3.76    26.60     7.68  20400.     6.56  17407.     0.00      0.     14.24  37807.     3.36    4.84   318.36
   3.77    26.70     7.68  20380.     6.55  17391.     0.00      0.     14.23  37772.     3.36    4.84   318.36
   3.79    26.80     7.67  20361.     6.54  17376.     0.00      0.     14.21  37737.     3.36    4.84   318.36
   3.80    26.90     7.66  20341.     6.54  17361.     0.00      0.     14.20  37702.     3.37    4.83   318.36
   3.81    27.00     7.65  20321.     6.53  17346.     0.00      0.     14.19  37667.     3.37    4.83   318.36
   3.83    27.10     7.65  20302.     6.53  17331.     0.00      0.     14.17  37632.     3.37    4.83   318.36
   3.84    27.20     7.64  20292.     6.52  17323.     0.00      0.     14.17  37615.     3.38    4.82   318.36  CENTRAL SW
   3.85    27.30     7.64  20272.     6.52  17308.     0.00      0.     14.15  37581.     3.38    4.82   318.36
   3.87    27.40     7.63  20253.     6.51  17293.     0.00      0.     14.14  37546.     3.38    4.82   318.36
   3.88    27.50     7.62  20233.     6.51  17278.     0.00      0.     14.13  37511.     3.39    4.81   318.36
   3.89    27.60     7.62  20223.     6.50  17271.     0.00      0.     14.12  37494.     3.39    4.81   318.36  MILL-FACTORY
   3.91    27.70     7.61  20204.     6.50  17256.     0.00      0.     14.11  37460.     3.39    4.81   318.36
   3.92    27.80     7.61  20205.     6.50  17259.     0.00      0.     14.11  37464.     3.39    4.81   318.46  BAUSCH & LOMB
   3.93    27.90     7.60  20186.     6.49  17244.     0.00      0.     14.09  37430.     3.40    4.80   318.46
   3.95    28.00     7.59  20167.     6.49  17230.     0.00      0.     14.08  37397.     3.40    4.80   318.46
   3.96    28.10     7.59  20148.     6.48  17215.     0.00      0.     14.07  37363.     3.40    4.80   318.46
   3.97    28.20     7.58  20129.     6.48  17201.     0.00      0.     14.06  37330.     3.40    4.80   318.46
   3.99    28.30     7.58  20120.     6.47  17193.     0.00      0.     14.05  37313.     3.41    4.79   318.46  CARTHAGE SW
   4.00    28.40     7.57  20101.     6.47  17179.     0.00      0.     14.04  37280.     3.41    4.79   318.46
   4.01    28.50     7.56  20082.     6.46  17164.     0.00      0.     14.02  37246.     3.41    4.79   318.46
   4.03    28.60     7.55  20063.     6.46  17150.     0.00      0.     14.01  37213.     3.42    4.78   318.46
   4.04    28.70     7.55  20044.     6.45  17135.     0.00      0.     14.00  37180.     3.42    4.78   318.46
   4.05    28.80     7.54  20035.     6.45  171[illegible]     0.00      0.     13.99  37163.     3.42    4.78   318.46  LEXINGTON SW
   4.07    28.90     7.54  20016.     6.44  17114.     0.00      0.     13.98  37130.     3.42    4.78   318.46
   4.08    29.00     7.[illegible]3  19997.     6.44  17099.     0.00      0.     13.97  37096.     3.43    4.77   318.46
   4.09    29.10     7.52  19979.     6.43  17085.     0.00      0.     13.95  37063.     3.43    4.77   318.46
   4.11    29.20     7.52  19960.     6.43  17070.     0.00      0.     13.94  37030.     3.43    4.77   318.46
   4.12    29.30     8.49  22692.     6.61  17657.     0.00      0.     15.10  40348.     3.45    4.75   320.46  SETH GREEN SW
   4.13    29.40     8.48  22670.     6.60  17642.     0.00      0.     15.08  40312.     3.45    4.75   320.46
   4.15    29.50     8.47  22649.     6.60  17627.     0.00      0.     15.07  40276.     3.46    4.74   320.46
   4.16    29.60     8.47  22628.     6.59  17612.     0.00      0.     15.06  40239.     3.46    4.74   320.46
   4.17    29.70     8.46  22606.     6.58  17597.     0.00      0.     15.04  40203.     3.47    4.73   320.46
   4.19    29.80     8.45  22585.     6.58  17582.     0.00      0.     15.03  40167.     3.47    4.73   320.46
   4.20    29.90     8.44  22564.     6.57  17567.     0.00      0.     15.02  40131.     3.47    4.73   320.46
   4.21    30.00    11.05  29802.     6.56  17695.     0.00      0.     17.61  47497.     3.51    4.69   323.46  MAPLEWOOD SW
   4.23    30.10    11.03  29766.     6.55  17675.     0.00      0.     17.59  47441.     3.52    4.68   323.46
   4.24    30.20    11.02  29730.     6.54  17655.     0.00      0.     17.57  47385.     3.53    4.67   323.46
   4.25    30.30    11.01  29695.     6.54  17635.     0.00      0.     17.54  47330.     3.54    4.66   323.46
   4.27    30.40    12.98  38040.    10.53  30868.     0.01     26.     23.52  68934.     3.61    4.59   351.46  KODAK STP
   4.28    30.50    12.85  37679.    10.43  30585.     0.03     77.     23.32  68341.     3.69    4.51   351.46
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                                        STREAM ASSIMILATION CAPACITY                                    PAGE   1

                                       PRESENT LOADINGS MATCO/10                              REPORT PRINTED  2/ 4/

                        ----------------------- OXYGEN DEMAND ----------------------------- ---- OXYGEN ---
                        CARBONACEOUS     NITROGENEOUS       BENTHIC            TOTAL        DEFICIT  LEVEL     FLOW
   TIME     DIST.      MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS    MG/L   POUNDS     MG/L    MG/L      MGD
 -------  -------   ------- -------  ------- -------  ------- -------  ------- -------  ------- -------  -------
    4.29    30.60     12.73  37321.    10.34  30304.     0.04    128.    23.11  67754.     3.76    4.44   351.46
    4.31    30.70     12.61  36967.    10.24  30026.     0.06    180.    22.92  67173.     3.84    4.36   351.46
    4.32    30.80     12.49  36616.    10.15  29751.     0.08    231.    22.72  66598.     3.91    4.29   351.46
    4.33    30.90     12.37  36268.    10.06  29478.     0.10    282.    22.53  66028.     3.98    4.22   351.46
    4.35    31.00     12.26  35924.     9.96  29207.     0.11    333.    22.33  65465.     4.05    4.15   351.46
    4.36    31.10     12.14  35583.     9.87  28939.     0.13    385.    22.14  64907.     4.12    4.08   351.46
    4.38    31.20     12.02  35245.     9.78  28674.     0.15    436.    21.96  64355.     4.19    4.01   351.46
    4.39    31.30     11.91  34911.     9.69  28411.     0.17    487.    21.77  63809.     4.25    3.95   351.46
    4.40    31.40     11.80  34579.     9.60  28150.     0.18    539.    21.58  63268.     4.32    3.88   351.46
    4.42    31.50     11.69  34251.     9.52  27892.     0.20    590.    21.40  62732.     4.38    3.82   351.46
    4.43    31.60     11.57  33926.     9.43  27636.     0.22    641.    21.22  62203.     4.44    3.76   351.46
    4.45    31.70     11.46  33604.     9.34  27382.     0.24    692.    21.04  61678.     4.50    3.70   351.46
    4.46    31.80     11.36  33285.     9.26  27131.     0.25    744.    20.87  61159.     4.56    3.64   351.46
    4.47    31.90     11.25  32969.     9.17  26882.     0.27    795.    20.69  60646.     4.62    3.58   351.46
    4.49    32.00     11.14  32656.     9.09  26635.     0.29    846.    20.52  60137.     4.68    3.52   351.46
    4.50    32.10     11.04  32346.     9.00  26391.     0.31    898.    20.34  59634.     4.73    3.47   351.46
    4.51    32.20     10.93  32039.     8.92  26149.     0.32    949.    20.17  59136.     4.79    3.41   351.46
    4.53    32.30     10.83  31734.     8.84  25909.     0.34   1000.    20.01  58643.     4.84    3.36   351.46
    4.54    32.40     10.72  31433.     8.76  25671.     0.36   1052.    19.84  58156.     4.89    3.31   351.46
    4.56    32.50     10.62  31135.     8.68  25435.     0.38   1103.    19.68  57673.     4.94    3.26   351.46
    4.57    32.60     10.52  30839.     8.60  25202.     0.39   1154.    19.51  57195.     4.99    3.21   351.46
    4.58    32.70     10.42  30546.     8.52  24971.     0.41   1205.    19.35  56723.     5.04    3.16   351.46
    4.60    32.80     10.32  30257.     8.44  24742.     0.43   1257.    19.19  56255.     5.09    3.11   351.46
    4.61    32.90     10.22  29969.     8.36  24514.     0.45   1308.    19.03  55792.     5.13    3.07   351.46
    4.63    33.00     10.13  29685.     8.29  24290.     0.46   1359.    18.88  55334.     5.18    3.02   351.46
    4.64    33.10     10.03  29403.     8.21  24067.     0.48   1411.    18.72  54880.     5.22    2.98   351.46
    4.65    33.20      9.94  29124.     8.14  23846.     0.50   1462.    18.57  54432.     5.26    2.94   351.46
    4.67    33.30      9.84  28847.     8.06  23627.     0.52   1513.    18.42  53988.     5.30    2.90   351.46
    4.68    33.40      9.75  28574.     7.99  23410.     0.53   1565.    18.27  53548.     5.35    2.85   351.46
    4.69    33.50      9.66  28302.     7.91  23195.     0.55   1616.    18.12  53113.     5.39    2.81   351.46
    4.71    33.60      9.56  28034.     7.84  22983.     0.57   1667.    17.97  52683.     5.42    2.78   351.46
    4.72    33.70      9.47  27767.     7.77  22772.     0.59   1718.    17.83  52257.     5.46    2.74   351.46
    4.74    33.80      9.38  27504.     7.70  22563.     0.60   1770.    17.68  51836.     5.50    2.70   351.46
    4.75    33.90      9.29  27243.     7.63  22356.     0.62   1821.    17.54  51419.     5.54    2.66   351.46
    4.76    34.00      9.48  27880.     7.83  23019.     0.01     19.    17.31  50918.     5.56    2.64   352.71   IRON-ST PAUL
    4.78    34.10      9.39  27623.     7.75  22788.     0.02     56.    17.16  50467.     5.63    2.57   352.71
    4.79    34.20      9.30  27368.     7.67  22559.     0.03     93.    17.00  50020.     5.69    2.51   352.71
    4.80    34.30      9.22  27115.     7.59  22332.     0.04    131.    16.85  49578.     5.76    2.44   352.71
    4.82    34.40      9.13  26865.     7.52  22108.     0.06    166.    16.71  49141.     5.83    2.37   352.71
    4.83    34.50      9.05  26617.     7.44  21886.     0.07    206.    16.56  48708.     5.89    2.31   352.71
    4.84    34.60      8.96  26371.     7.37  21666.     0.08    243.    16.41  48280.     5.96    2.24   352.71
    4.86    34.70      8.88  26128.     7.29  21448.     0.10    280.    16.27  47856.     6.02    2.18   352.71
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APPENDIX B - CHEMICAL AND PHYSICAL MEASUREMENTS CONDUCTED ON THE GENESEE RIVER

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                                        GENESEE RIVER STUDY

 SMNO  STA  MILE  CORP  TYPE   SAMP    DATE    TIME   PH  TEMPC    DO  BOD5  TOC  TKN  NH3N  ORGN   NO2N  NO3N  T-IP
 ----  ---  ----  ----  ----   ----  --------  ----  ---  -----  ----  ----  ---  ---  ----  ----  -----  ----  ----
    1    1   347     1    10   9400   7/19/73  1600
    1    2   254     2     0   9409   7/19/73  1515  8.1   23.4  10.6   3.4
    1    3   215     1     0   9410   7/19/73  1545  8.1   23.4  10.9  10.0       0.1  0.09   0.0  0.017  0.05  0.03
    1    4   147     2     0   9407   7/19/73  1140  8.2   23.4  11.3   2.2
    1    5   122     1     0   9408   7/19/73  1210  8.2   23.3  12.1   4.4       0.1  0.12   0.0  0.021  0.05  0.03
    1    6   109     1     0   9406   7/19/73  1040  8.2   23.9  10.3   9.0       0.3  0.21   0.1  0.021  0.07  0.03
    1    7    91     2     0   9405   7/19/73  1017  8.3   24.0   8.3   2.4
    1    8    47     1     0   9401   7/18/73  1320  8.2   25.3   7.6   5.3   8.  0.6  0.55   0.1  0.030  0.09  0.39
    1    9    34     2     0   9402   7/18/73  1345  8.5   25.9   5.8   5.0
    1   10    22     2     0   9403   7/18/73  1415  7.9   26.0   5.0   4.9
    1   11     7     1     0   9404   7/18/73  1502  8.1   24.4   6.0   5.0       0.9  0.80   0.1  0.037  0.07  0.11

    2    1   347     1     0   9419   8/ 2/73  1113  8.2   23.3   9.7   2.0   7.  1.0  0.02   1.0  0.016  0.15  0.03
    2    2   254     2     0   9420   8/ 2/73  1159  8.1   23.6   8.8   1.4
    2    3   215     1     0   9421   8/ 2/73  1243  8.1   23.1   8.6   2.1   9.  0.0  0.00   0.0  0.016  0.11  0.03
    2    4   147     2     0   9418   8/ 1/73  1542  8.1   24.2   8.6   2.0
    2    5   122     1     0   9417   8/ 1/73  1511  8.2   23.8   8.3   4.3  15.  0.4  0.38   0.0  0.035  0.01  0.08
    2    6   109     1     0   9416   8/ 1/73  1443  8.1   25.1   6.9   3.4  11.  0.4  0.27   0.1  0.025  0.03  0.11
    2    7    91     2     0   9415   8/ 1/73  1420  8.3   24.7   8.5   3.1
    2    8    47     1     0   9411   8/ 1/73  1015  8.3   26.6   5.5   5.7   1.  0.8  0.22   0.6  0.030  0.27  0.10
    2    9    34     2     0   9412   8/ 2/73  1045  7.1   24.9   4.9   5.0
    2   10    22     2     0   9413   8/ 2/73  1113  7.5   25.9   4.5   4.1
    2   11     7     1     0   9414   8/ 1/73  1143  8.4   22.9   3.9   3.2   1.  1.2  0.96   0.2  0.023  0.01  0.07
    2  101    34     1     0   9383   8/ 2/73  1030                      16.0   1.  2.2  1.05   1.2  0.071  0.64  0.05

    3    1   347     1     0   9432   8/16/73  1045  8.4   23.4   6.9   5.0  14.  0.6  0.00   0.6  0.012  0.00  0.04
    3    2   254     2     0   9431   8/16/73  1115  8.3   23.6   7.5   2.1   5.  1.6  0.16   1.4
    3    3   215     1     0   9430   8/16/73  1140  8.4   22.7   7.4   3.2   8.  0.8  0.00   0.8  0.033  0.02  0.13
    3    4   147     2     0   9429   8/15/73  1720  8.2   24.9   7.8   2.1  20.  0.7  0.63   0.1
    3    5   122     1     0   9428   8/16/73  1655  8.2   24.5   3.7   7.2  12.  3.1  1.00   2.1  0.010  0.00  0.33
    3    6   109     1     0   9427   8/16/73  1630  8.6   25.9   7.2   3.2  15.  2.5  0.13   2.4  0.010  0.00  0.11
    3    7    91     2     0   9426   8/15/73  1545  8.6   25.4   7.5   3.1  25.  1.0  0.21   0.8
    3    8    47     1     0   9425   8/16/73  1220  8.7   27.6   6.3   6.2  39.  1.9  0.86   1.0  0.020  0.00  0.16
    3    9    34     2     0   9424   8/15/73  1245  8.3   27.9   7.2   8.9  12.  1.9  0.81   1.1
    3   10    22     2     0   9423   8/15/73  1310  8.2   27.2   3.4   6.0   3.  1.0  1.03   0.0
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                                                          GENESEE RIVER STUDY

SMNO  STA  MILE  CORP  TYPE   SAMP   CL     F     SO4    CN    PHENOL    AS    BA    CD    CR    CU    FE     HG     NI
----  ---  ----  ----  ----   ----  ----  ----   ----  ----  --------  ----   ---  ----  ----  ----  ----  ------   ---
   1    1   347     1    10   9400
   1    2   254     2     0   9409
   1    3   215     1     0   9410  207.  0.00    96.           0.000  0.00   0.5  0.00  0.53  0.03  0.79  0.0000   0.1
   1    4   147     2     0   9407
   1    5   122     1     0   9408  207.  0.00    83.           0.010  0.00   0.0  0.00  0.21  0.00  0.46  0.0000   0.0
   1    6   109     1     0   9406   70.  0.00   128.           0.030  0.00   0.5  0.00  0.17  0.04  0.28           0.0
   1    7    91     2     0   9405
   1    8    47     1     0   9401   48.  0.04    36.  0.30     0.060  0.00   0.5  0.03  0.00  0.00  0.22           0.1
   1    9    34     2     0   9402
   1   1C    22     2     0   9403
   1   11     7     1     0   9404   42.  0.00   115.           0.050  0.00   0.5  0.00  0.50  0.03  1.12           0.0


   2    1   347     1     0   9419  194.  0.02    22.  0.20     0.020  0.00   0.5  0.00  0.00  0.02  0.74  0.0006   0.1
   2    2   254     2     0   9420
   2    3   215     1     0   9421  143.  0.02    72.  0.30     0.110  0.00   0.0  0.02  0.03  0.00  0.43  0.0000   0.1
   2    4   147     2     0   9418
   2    5   122     1     0   9417  188.  0.08   145.  0.30     0.000  0.00   0.0  0.00  0.00  0.00  0.22  0.0010   0.1
   2    6   109     1     0   9416  117.  0.10   114.  0.10     0.000  0.00   0.0  0.00  0.00  0.00  0.40  0.0004   0.0
   2    7    91     2     0   9415
   2    8    47     1     0   9411   57.  0.12   171.  0.00     0.150  0.00   0.0  0.03  0.00  0.03  0.31  0.0000   0.0
   2    9    34     2     0   9412
   2   1C    22     2     0   9413
   2   11     7     1     0   9414   63.  0.12    46.  0.10     0.020  0.00   0.0  0.00  0.00  0.02  0.59  0.0022   0.1
   2  101    34     1     0   9383   57.  0.20    33.  4.30     0.080  0.00   0.5  0.03  0.00  0.09  0.53  0.0150   0.0


   3    1   347     1     0   9432  280.  0.00    89.  0.00     0.040  0.00   0.0  0.00  0.00  0.05  0.32  0.0037   0.0
   3    2   254     2     0   9431
   3    3   215     1     0   9430  236.  0.00   167.  0.10     0.030  0.00   0.0  0.00  0.00  0.03  0.35  0.0098   0.0
   3    4   147     2     0   9429
   3    5   122     1     0   9428  218.  0.00   170.  0.00     0.030  0.00   0.0  0.00  0.00  0.00  0.25  0.0038   0.0
   3    6   109     1     0   9427  120.  0.00    80.  0.00     0.040  0.00   0.0  0.00  0.00  0.00  0.23  0.0036   0.0
   3    7    91     2     0   9426
   3    8    47     1     0   9425   99.  0.00    92.  0.00     0.020  0.00   0.0  0.00  0.00  0.00  0.48  0.0056   0.0
   3    9    34     2     0   9424
   3   1C    22     2     0   9423
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                                            GENESEE RIVER STUDY

SHNO  STA  MILE  CORP  TYPE  SAMP   PB    SE     ZN     TS      VS     TSS    VSS    TDS    VDS
----  ---- ----  ----  ----  ----   ---  -----  -----  ------  -----  -----  ----  ------  -----
   1    1   347     1    10  9400
   1    2   254     2     0  9409
   1    3   215     1     0  9410  0.0          0.038   264.0  136.0   28.0  28.0   236.0  108.0
   1    4   147     2     0  9407
   1    5   122     1     0  9408  0.0          0.048   392.0  110.0   96.0  64.0   296.0   46.0
   1    6   109     1     0  9406  0.0          0.088   492.0  100.0   72.0  52.0   420.0   48.0
   1    7    91     2     0  9405
   1    8    47     1     0  9401  0.7  0.000  0.036   536.0  320.0   88.0  44.0   448.0  276.0
   1    9    34     2     0  9402
   1   1C    22     2     0  9403  0.6
   1   11     7     1     0  9404  0.0          0.098   244.0  100.0   48.0  32.0   196.0   68.0

   2    1   347     1     0  9419  0.0  0.001  0.051   734.0  123.0   67.0   3.0   667.0  120.0
   2    2   254     2     0  9420
   2    3   215     1     0  9421  0.0  0.002  0.051   648.0  130.0   69.0   1.0   579.0  129.0
   2    4   147     2     0  9418
   2    5   122     1     0  9417  0.2  0.003  0.061   887.0  273.0   33.0   3.0   854.0  270.0
   2    6   109     1     0  9416  0.0  0.003  0.046   569.0   86.0   27.0  12.0   542.0   74.0
   2    7    91     2     0  9415
   2    8    47     1     0  9411  0.0  0.002  0.051   423.0   74.0   11.0   5.0   412.0   69.0
   2    9    34     2     0  9412
   2   1C    22     2     0  9413
   2   11     7     1     0  9414  0.0  0.002  0.046   443.0   95.0  108.0  12.0   335.0   83.0
   2  101    34     1     0  9383  0.0         0.091   513.0  115.0  184.0  68.0   329.0   47.0

   3    1   347     1     0  9432  0.0  0.004  0.000   805.0   85.0   84.0  30.0   721.0   55.0
   3    2   254     2     0  9431
   3    3   215     1     0  9430  0.0  0.002  0.015   895.0   81.0  143.0  43.0   752.0   38.0
   3    4   147     2     0  9429
   3    5   122     1     0  9428  0.0  0.003  0.025   775.0  125.0   11.4   5.7   763.6  119.3
   3    6   109     1     0  9427  0.0  0.003  0.030   467.0   82.0  130.0  56.0   337.0   26.0
   3    7    91     2     0  9426
   3    8    47     1     0  9425  0.0  0.002  0.095   470.0  147.0   46.0  30.0   424.0  117.0
   3    9    34     2     0  9424
   3   1C    22     2     0  9423
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                                         GENESEE RIVER STUDY

SMNO  STA  MILE  CORP  TYPE   SAMP   --DATE   TIME  PH   TEMPC   DO   BOD5  TOC  TKN  NH3N  ORGN   NO2N  NO3N  T-IP
----  ---  ----  ----  ----  -----  --------  ----  ---  -----  ----  ----  ---  ---  ----  ----  -----  ----  ----
   3   11     7     1     0   9422   8/16/73  1331  8.1   26.0   4.3   6.2  16.  1.9  0.68   1.2  0.020  0.01  0.02


   4    1   347     1     0   9444   9/11/73  1330  8.3   19.3   7.3   0.9   4.  0.2  0.00   0.2  0.031  0.25  0.03
   4    2   254     2     0   9443   9/11/73  1500  8.3   19.2   7.3   0.7  14.  0.2  0.00   0.2  0.027  0.21  0.03
   4    3   215     1     0   9442   9/11/73  1600  8.2   19.6   7.5   0.9   9.  0.2  0.00   0.2  0.022  0.17  0.03
   4    4   147     2     0   9441   9/11/73  1650  8.2   20.5   7.6   1.1   9.  0.2  0.24   0.0  0.020  0.14  0.06
   4    5   122     1     0   9440   9/11/73  1715  8.1   20.5   6.2   1.0   8.  0.7  0.00   0.7  0.022  0.11  0.06
   4    6   109     1     0   9439   9/11/73  1135  8.1   21.1   6.2   1.3   8.  0.5  0.11   0.4  0.022  0.10  0.03
   4    7    91     2     0   9438   9/11/73  1110  8.1   21.2   5.9   1.6  15.  0.5  0.00   0.5  0.022  0.09  0.06
   4    8    47     1     0   9437   9/10/73  1345  8.0   23.1   6.8   1.0  15.  0.5  0.18   0.3  0.022  0.07  0.12
   4    9    34     2     0   9436   9/10/73  1435  8.0   23.5   5.9   0.8   8.  1.4  0.51   0.9  0.022  0.06  0.12
   4   1C    22     2     0   9435   9/10/73  1505  8.1   23.5   5.4   1.1  10.  0.9  0.33   0.6  0.024  0.05  0.22
   4   11     7     1     0   9434   9/10/73  1540  8.2   23.2   5.1   1.6   7.  0.7  0.00   0.7  0.030  0.07  0.31


   5    1   347     1     0   9455   9/12/73  1110  8.4   17.7   7.3   2.3   9.  0.2  0.00   0.2  0.027  0.24  0.06
   5    2   254     2     0   9454   9/12/73  1230  8.3   18.3   7.3   1.1   7.  0.2  0.00   0.2  0.031  0.28  0.03
   5    3   215     1     0   9453   9/12/73  1315  8.3   18.6   7.6   3.5   8.  0.2  0.00   0.2  0.027  0.22  0.00
   5    4   147     2     0   9452   9/12/73  1350  8.2   19.1   7.6   0.6   7.  0.2  0.00   0.2  0.022  0.17  0.00
   5    5   122     1     0   9451   9/12/73  1420  8.1   19.6   5.5   1.1   5.  1.4  0.12   1.3  0.027  0.16  0.06
   5    6   109     1     0   9450   9/12/73  1530  8.2   20.5   6.4  22.0   4.  0.6  0.02   0.6  0.025  0.15  0.03
   5    7    91     2     0   9449   9/12/73  1600  8.1   20.6   6.1  11.0   1.  0.5  0.00   0.5  0.022  0.12  0.03
   5    8    47     1     0   9448   9/13/73  1040  8.1   21.7   6.2   0.3  14.  0.2  0.06   0.1  0.028  0.13  0.06
   5    9    34     2     0   9447   9/13/73  1100  8.2   22.6   6.0   3.5  15.  1.5  1.07   0.4  0.028  0.12  0.06
   5   1C    22     2     0   9446   9/13/73  1145  8.2   22.8   5.3   2.2  15.  2.0  1.22   0.8  0.028  0.12  0.11
   5   11     7     1     0   9445   9/13/73  1200  8.3   22.9   4.1   0.9  16.  2.6  2.15   0.5  0.029  0.13  0.11


   6    1   347     1     0   9466   9/13/73  1605  8.3   18.3   7.1   1.2  15.  0.2  0.00   0.2  0.023  0.24  0.03
   6    2   254     2     0   9465   9/13/73  1705  8.3   17.8   6.7   1.6  15.  0.2  0.00   0.2  0.023  0.23  0.06
   6    3   215     1     0   9464   9/13/73  1745  8.2   18.2   7.4   1.6  18.  0.2  0.00   0.2  0.020  0.21  0.03
   6    4   147     2     0   9463   9/13/73  1830  8.2   18.5   7.6  16.0  26.  0.2  0.00   0.2  0.019  0.20  0.03
   6    5   122     1     0   9462   9/14/73  1000  8.1   18.4   6.1   2.4  14.  1.0  0.46   0.5  0.024  0.16  0.06
   6    6   109     1     0   9461   9/14/73  1130  8.2   19.2   5.8   1.5  11.  0.5  0.00   0.5  0.024  0.15  0.06
   6    7    91     2    10  13213   9/14/73  1200
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GENESEE RIVER STUDY.

SPNO	STA	MILE	CORP	TYPE	SAMP	CL	F	SO4	CN	PHENOL	AS	BA	CD	CR	CU	FE	HG	NI
3	11	7	1	0	9422	66.	0.00	76.	0.03	0.020	0.00	0.0	0.00	0.00	0.05	0.38	0.0036	0.1
4	1	347	1	0	9444	47.	0.00	46.		INTER	0.00	0.0	0.00	0.04	0.04	1.57	0.0015	0.0
4	2	254	2	0	9443	44.												
4	3	215	1	0	9442	43.	0.00	96.	0.00	0.000	0.00	0.4	0.00	0.00	0.03	0.26	0.0008	0.2
4	4	147	2	0	9441	42.												
4	5	122	1	0	9440	48.	0.00	76.	0.00	0.000	0.00	0.4	0.00	0.02	0.06	0.29	0.0009	0.0
4	6	109	1	0	9439	37.	0.00	71.	0.01	0.000	0.00	0.4	0.00	0.00	0.03	0.37	0.0062	0.0
4	7	91	2	0	9438	38.		58.										
4	8	47	1	0	9437	46.	0.00	51.	0.00	0.060	0.00	0.0	0.00	0.04	0.04	0.14	0.0053	0.0
4	9	34	2	0	9436	52.												
4	1C	22	2	0	9435	59.												
4	11	7	1	0	9434	63.	0.01	83.	0.00	0.020	0.00	0.0	0.00	0.00	0.02	0.23	0.0035	0.3
5	1	347	1	0	9455	54.		78.				0.7	0.00	0.00	0.00	1.91		
5	2	254	2	0	9454	51.												0.0
5	3	215	1	0	9453	46.		111.				0.4	0.00	0.04	0.02	0.64		0.0
5	4	147	2	0	9452	44.												
5	5	122	1	0	9451	47.		84.				0.0	0.00	0.06	0.05	0.57		0.0
5	6	109	1	0	9450	38.		81.				0.0	0.00	0.02	0.00	0.48		0.0
5	7	91	2	0	9449	38.												
5	8	47	1	0	9448	42.		64.				0.7	0.00	0.02	0.00	0.11		0.0
5	9	34	2	0	9447	47.												
5	1C	22	2	0	9446	47.												
5	11	7	1	0	9445	52.		88.				0.0	0.00	0.06	0.02	0.34		0.0
6	1	347	1	0	9466	56.		58.				0.0	0.00	0.00	0.04	1.26		0.0
6	2	254	2	0	9465	55.												
6	3	215	1	0	9464	50.		121.				0.7	0.00	0.06	0.02	0.86		0.2
6	4	147	2	0	9463	44.												
6	5	122	1	0	9462	52.		124.				0.4	0.00	0.04	0.04	0.26		0.0
6	6	109	1	0	9461	43.		99.				0.7	0.00	0.00	0.02	0.57		0.1
6	7	91	2	10	13213													

GENESEE RIVER STUDY

SMNO	STA	*ILE	CORP	TYPE	SAMP	PB	SE	ZN	TS	VS	TSS	VSS	TDS	VDS
3	11	7	1	0	9422	0.0	0.004	0.050	317.0	53.0	36.0	18.4	281.0	34.6
4	1	347	1	0	9444	0.0	0.000	0.000	368.0	47.0	70.0	11.0	298.0	36.0
4	2	254	2	0	9443									
4	3	215	1	0	9442	0.0	0.000	0.015	417.0	72.0	35.0	2.0	382.0	70.0
4	4	147	2	0	9441									
4	5	122	1	0	9440	0.0	0.000	0.025	427.0	100.0	17.0	5.0	410.0	95.0
4	6	109	1	0	9439	0.0	0.000	0.010	425.0	157.0	17.0	6.0	408.0	151.0
4	7	91	2	0	9438									
4	8	47	1	0	9437	0.0	0.000	0.000	343.0	35.0	15.0	3.0	328.0	32.0
4	9	34	2	0	9436									
4	1C	22	2	0	9435									
4	11	7	1	0	9434	0.0	0.000	0.025	447.0	42.0	19.0	7.0	428.0	35.0
5	1	347	1	0	9455	0.0		0.030	350.0	60.0	42.0	8.0	308.0	52.0
5	2	254	2	0	9454									
5	3	215	1	0	9453	0.0		0.030	433.0	105.0	22.0	4.0	411.0	101.0
5	4	147	2	0	9452									
5	5	122	1	0	9451	0.7		0.035	510.0	158.0	64.0	5.0	446.0	153.0
5	6	109	1	0	9450	0.0		0.030	332.0	40.0	16.0	5.0	316.0	35.0
5	7	91	2	0	9449									
5	8	47	1	0	9448	0.0		0.030	372.0	45.0	6.0	2.0	366.0	4.3
5	9	34	2	0	9447									
5	1C	22	2	0	9446									
5	11	7	1	0	9445	0.0		0.038	440.0	80.0	2.0	1.0	438.0	79.0
6	1	347	1	0	9466	0.0		0.025	668.0	316.0	30.0	12.0	638.0	304.0
6	2	254	2	0	9465									
6	3	215	1	0	9464	0.0		0.025	604.0	192.0	18.0	11.0	586.0	181.0
6	4	147	2	0	9463									
6	5	122	1	0	9462	0.0		0.030	512.0	99.0	9.0	6.0	503.0	93.0
6	6	109	1	0	9461	0.0		0.030	460.0	144.0	2.0	1.0	458.0	143.0
6	7	91	2	10	13213									

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                                    GENESEE RIVER STUDY

SMNO  STA  MILE  CORP  TYPE   SAMP     DATE    TIME  PH  TEMPC   DO  BOD5  TOC  TKN  NH3N  ORGN   NO2N  NO3N  T-IP
----  ---  ----  ----  ----  -----  --------  ----  ---  -----  ---  ----  ---  ---  ----  ----  -----  ----  ----
   6    8    47     1    10  13212   9/14/73  1200
   6    9    34     2    10  13211   9/14/73  1200
   6   1C    22     2    10  13210   9/14/73  1200
   6   11     7     1    10  13209   9/14/73  1200


   7    1   347     1     0   9473   9/27/73  1030  8.2   15.6  8.7   2.2  10.  0.2  0.06   0.1  0.011  0.14  0.06
   7    2   254     2     0   9474   9/27/73  1100  8.2   15.8  8.4   2.2  14.  0.5  0.11   0.4  0.011  0.14  0.06
   7    3   215     1     0   9475   9/27/73  1135  8.1   16.4  7.8   2.4  11.  0.1  0.06   0.0  0.014  0.17  0.06
   7    4   147     2     0   9476   9/27/73  1205  8.1   15.4  8.1   2.0  10.  0.1  0.06   0.0  0.014  0.14  0.09
   7    5   122     1     0   9477   9/27/73  1230  8.0   16.0  7.5   2.2  17.  0.2  0.25   0.0  0.019  0.14  0.10
   7    6   1C9     1     0   9472   9/26/73  1830  8.0   15.3  9.3   2.4  14.  0.2  0.24   0.0  0.017  0.11  0.03
   7    7    91     2     0   9471   9/26/73  1810  7.9   15.7  7.4   2.8  10.  0.5  0.40   0.1  0.018  0.11  0.06
   7    8    47     1     0   9467   9/26/73  1430  8.1   16.3  8.8   2.2  15.  0.2  0.17   0.0  0.023  0.10  0.06
   7    9    34     2     0   9468   9/26/73  1515  8.1   16.7  8.0   2.8  10.  0.5  0.49   0.0  0.025  0.13  0.09
   7   1C    22     2     0   9469   9/26/73  1540  8.0   17.3  8.1   2.6  12.  1.9  0.57   1.3  0.028  0.13  0.06
   7   11     7     1     0   9470   9/26/73  1615  8.0   15.8  8.7   2.8  13.  1.2  0.68   0.5  0.028  0.12  0.05


   8    1   347     1     0   9486  10/19/73  1015  8.0   10.3  7.3   0.7   6.  0.3  0.13   0.2  0.017  0.17  0.03
   8    2   254     2     0   9487  10/19/73  1035  8.0   10.3  7.2   2.8   5.  0.3  0.11   0.2  0.017  0.16  0.03
   8    3   215     1     0   9485  10/19/73   945  7.9   10.4  7.9   1.1   7.  0.3  0.18   0.1  0.022  0.26  0.06
   8    4   147     2     0   9488  10/19/73  1120  7.9   12.0  7.6   2.5   9.  0.3  0.06   0.2  0.011  0.09  0.03
   8    5   122     1     0   9484  10/18/73  1800  7.9   15.2  7.8   2.0   3.  0.6  0.42   0.2  0.011  0.16  0.15
   8    6   109     1     0   9483  10/18/73  1720  8.1   13.2  8.3   0.9   9.  0.6  0.43   0.2  0.022  0.22  0.09
   8    7    91     2     0   9482  10/18/73  1700  8.0   13.3  8.9   2.0   7.  0.3  0.28   0.0  0.022  0.10  0.06
   8    8    47     1     0   9478  10/18/73  1315  8.1   14.3  8.9   2.1   6.  0.4  0.36   0.0  0.034  0.26  0.09
   8    9    34     2     0   9479  10/18/73  1400  7.9   15.9  8.9   1.5   1.  2.1  1.88   0.2  0.079  0.18  0.09
   8   10    22     2     0   9480  10/18/73  1440  7.9   15.2  6.8   2.6   5.  1.5  1.17   0.3  0.034  0.23  0.09
   8   11     7     1     0   9481  10/18/73  1515  7.6   15.5  6.2   2.7   3.  2.6  1.85   0.8  0.042  0.29  0.12
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GENESEE RIVER STUDY

SMNO	STA	MILE	CORP	TYPE	SAMP	CL	F	SO4	CN	PHENOL	AS	BA	CD	CR	CU	FE	HG	NI
6	8	47	1	10	13212													
6	9	34	2	10	13211													
6	10	22	2	10	13210													
6	11	7	1	10	13209													
7	1	347	1	0	9473	92.	0.00	61.	0.00	0.000	0.00	0.0	0.04	0.00	0.00	0.18	0.0028	0.0
7	2	254	2	0	9474	97.												
7	3	215	1	0	9475	111.	0.00	78.	0.00	0.000	0.00	0.0	0.00	0.00	0.00	0.62	0.0128	0.0
7	4	147	2	0	9476	104.												
7	5	122	1	0	9477	60.	0.00	107.	0.00	0.000	0.00	0.0	0.02	0.00	0.00	0.66	0.0110	0.0
7	6	109	1	0	9472	103.	0.00	115.	0.00	0.000	0.00	0.4	0.03	0.00	0.00	0.15	0.0026	0.1
7	7	91	2	0	9471	169.												
7	8	47	1	0	9467	59.	0.00	109.	0.00	0.000	0.00	0.0	0.00	0.00	0.00	0.40	0.0036	0.0
7	9	34	2	0	9468	60.												
7	10	22	2	0	9469	57.												
7	11	7	1	0	9470	47.	0.00	108.	0.00	0.000	0.00	0.4	0.03	0.00	0.00	0.15	0.0020	0.0
8	1	347	1	0	9486	250.	0.00	99.	0.05	0.000	0.00	0.4	0.00	0.00	0.12	0.43	0.0040	0.0
8	2	254	2	0	9487	250.												
8	3	215	1	0	9485	229.	0.70	137.	0.00	0.000	0.00	0.7	0.02	0.02	0.10	0.29	0.0032	0.0
8	4	147	2	0	9488	169.												
8	5	122	1	0	9484	188.	0.12	138.	0.05	0.550	0.00	1.0	0.02	0.04	0.14	0.14	0.0046	0.0
8	6	109	1	0	9483	105.	0.60	79.	0.00	0.050	0.00	0.7	0.00	0.00	0.12	0.29	0.0050	0.0
8	7	91	2	0	9482	83.												
8	8	47	1	0	9478	96.	0.00	64.	0.00	0.030	0.00	1.4	0.01	0.00	0.12	0.09	0.0036	0.0
8	9	34	2	0	9479	104.												
8	10	22	2	0	9480	95.												
8	11	7	1	0	9481	133.	0.00	101.	0.05	0.000	0.00	1.0	0.02	0.00	0.16	1.00	0.0058	0.0

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                                    GENESEE RIVER STUDY

SMNO  STA  MILE  CORP  TYPE   SAMP  PB    SE     ZN      TS     VS    TSS   VSS    TDS    VDS
----  ---- ----  ----  ----  ----- ---  -----  -----  ------  -----  ----- ----  ------  -----
   6     8   47     1    10  13212
   6     9   34     2    10  13211
   6    1C   22     2    10  13210
   6    11    7     1    10  13209

   7     1  347     1     0   9473 0.0  0.001  0.065   328.0  176.0   18.0   6.0   310.0  170.0
   7     2  254     2     0   9474
   7     3  215     1     0   9475 0.0  0.000  0.050   404.0  184.0   47.4  11.3   356.6  172.7
   7     4  147     2     0   9476
   7     5  122     1     0   9477 0.0  0.003  0.060   308.0  120.0   23.3   2.7   284.7  117.3
   7     6  109     1     0   9472 0.0  0.003  0.090   396.0  144.0   44.7   4.0   351.3  140.0
   7     7   91     2     0   9471
   7     8   47     1     0   9467 0.0  0.001  0.095   388.0  200.0   42.7   8.0   345.3  192.0
   7     9   34     2     0   9468
   7    1C   22     2     0   9469
   7    11    7     1     0   9470 0.0  0.004  0.125   304.0  188.0   25.4   3.3   278.6  184.7

   8     1  347     1     0   9486 0.0  0.000  0.024   864.0  107.0   56.0  14.0   808.0   93.0
   8     2  254     2     0   9487
   8     3  215     1     0   9485 0.0  0.001  0.014  1035.0  291.0   28.0  12.0  1007.0  279.0
   8     4  147     2     0   9488
   8     5  122     1     0   9484 0.0  0.000  0.024   811.0  140.0   26.0  14.0   785.0  126.0
   8     6  109     1     0   9483 0.0  0.001  0.024   628.0  124.0   32.0  14.0   596.0  110.0
   8     7   91     2     0   9482
   8     8   47     1     0   9478 0.0  0.003  0.024   600.0  144.0   56.0  16.0   544.0  128.0
   8     9   34     2     0   9479
   8    1C   22     2     0   9480
   8    11    7     1     0   9481 0.0  0.001  0.014   712.0  116.0   60.0  14.0   652.0  102.0
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GENESEE RIVER STUDY

STA	SMNI	MILE	CORP	TYPE	SAMP	CL	F	SO4	CN	PHENOL	AS	BA	CD	CR	CU	FE	HG	NI
1	1	347	1	10	9400													
1	2	347	1	0	9419	194.	0.02	22.	0.20	0.020	0.00	0.5	0.00	0.00	0.02	0.74	0.0006	0.1
1	3	347	1	0	9432	280.	0.00	89.	0.00	0.040	0.00	0.0	0.00	0.00	0.05	0.32	0.0037	0.0
1	4	347	1	0	9444	47.	0.00	46.		INTER	0.00	0.0	0.00	0.04	0.04	1.57	0.0015	0.0
1	5	347	1	0	9455	54.		78.				0.7	0.00	0.00	0.00	1.91		
1	6	347	1	0	9466	56.		58.				0.0	0.00	0.00	0.04	1.26		0.0
1	7	347	1	0	9473	92.	0.00	61.	0.00	0.000	0.00	0.0	0.04	0.00	0.00	0.18	0.0028	0.0
1	8	347	1	0	9486	250.	0.00	99.	0.05	0.000	0.00	0.4	0.00	0.00	0.12	0.43	0.0040	0.0
2	1	254	2	0	9409													
2	2	254	2	0	9420													
2	3	254	2	0	9431													
2	4	254	2	0	9443	44.												
2	5	254	2	0	9454	51.												0.0
2	6	254	2	0	9465	55.												
2	7	254	2	0	9474	97.												
2	8	254	2	0	9487	250.												
3	1	215	1	0	9410	207.	0.00	96.		0.000	0.00	0.5	0.00	0.53	0.03	0.79	0.0000	0.1
3	2	215	1	0	9421	143.	0.02	72.	0.30	0.110	0.00	0.0	0.02	0.03	0.00	0.43	0.0000	0.1
3	3	215	1	0	9430	236.	0.00	167.	0.10	0.030	0.00	0.0	0.00	0.00	0.03	0.35	0.0098	0.0
3	4	215	1	0	9442	43.	0.00	96.	0.00	0.000	0.00	0.4	0.00	0.00	0.03	0.26	0.0008	0.2
3	5	215	1	0	9453	46.		111.				0.4	0.00	0.04	0.02	0.64		0.0
3	6	215	1	0	9464	50.		121.				0.7	0.00	0.06	0.02	0.86		0.2
3	7	215	1	0	9475	111.	0.00	78.	0.00	0.000	0.00	0.0	0.00	0.00	0.00	0.62	0.0128	0.0
3	8	215	1	0	9485	229.	0.70	137.	0.00	0.000	0.00	0.7	0.02	0.02	0.10	0.29	0.0032	0.0
4	1	147	2	0	9407													
4	2	147	2	0	9418													
4	3	147	2	0	9429													
4	4	147	2	0	9441	42.												
4	5	147	2	0	9452	44.												
4	6	147	2	0	9463	44.												

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                                         GENESEE RIVER STUDY

  STA   SMNC   MILE   CORP   TYPE   SAMP   PB     SE      ZN       TS      VS    TSS   VSS     TDS    VDS
  ----  ----   ----   ----   ----   -----  ---   -----   -----   ------  -----  -----  ----  ------  -----
     1     1    347      1     10   9400
     1     2    347      1      0   9419  0.0   0.001   0.051    734.0  123.0   67.0   3.0   667.0  120.0
     1     3    347      1      0   9432  0.0   0.004   0.000    805.0   85.0   84.0  30.0   721.0   55.0
     1     4    347      1      0   9444  0.0   0.000   0.000    368.0   47.0   70.0  11.0   298.0   36.0
     1     5    347      1      0   9455  0.0           0.030    350.0   60.0   42.0   8.0   308.0   52.0
     1     6    347      1      0   9466  0.0           0.025    668.0  316.0   30.0  12.0   638.0  304.0
     1     7    347      1      0   9473  0.0   0.001   0.065    328.0  176.0   18.0   6.0   310.0  170.0
     1     8    347      1      0   9486  0.0   0.000   0.024    864.0  107.0   56.0  14.0   808.0   93.0

     2     1    254      2      0   9409
     2     2    254      2      0   9420
     2     3    254      2      0   9431
     2     4    254      2      0   9443
     2     5    254      2      0   9454
     2     6    254      2      0   9465
     2     7    254      2      0   9474
     2     8    254      2      0   9487

     3     1    215      1      0   9410  0.0           0.038    264.0  136.0   28.0  28.0   236.0  108.0
     3     2    215      1      0   9421  0.0   0.002   0.051    648.0  130.0   69.0   1.0   579.0  129.0
     3     3    215      1      0   9430  0.0   0.002   0.015    895.0   81.0  143.0  43.0   752.0   38.0
     3     4    215      1      0   9442  0.0   0.000   0.015    417.0   72.0   35.0   2.0   382.0   70.0
     3     5    215      1      0   9453  0.0           0.030    433.0  105.0   22.0   4.0   411.0  101.0
     3     6    215      1      0   9464  0.0           0.025    604.0  192.0   18.0  11.0   586.0  181.0
     3     7    215      1      0   9475  0.0   0.000   0.050    404.0  184.0   47.4  11.3   356.6  172.7
     3     8    215      1      0   9485  0.0   0.001   0.014   1035.0  291.0   28.0  12.0  1007.0  279.0

     4     1    147      2      0   9407
     4     2    147      2      0   9418
     4     3    147      2      0   9429
     4     4    147      2      0   9441
     4     5    147      2      0   9452
     4     6    147      2      0   9463
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GENESEE RIVER STUDY

STA	SMNO	MILE	CORP	TYPE	SAMP	DATE	TIME	PH	TEMPC	DO	BOD5	TOC	TKN	NH3N	ORGN	NO2N	NO3N	T-IP
4	7	147	2	0	9476	9/27/73	1205	8.1	15.4	8.1	2.0	10.	0.1	0.06	0.0	0.014	0.14	0.09
4	8	147	2	0	9488	10/19/73	1120	7.9	12.0	7.6	2.5	9.	0.3	0.06	0.2	0.011	0.09	0.03
5	1	122	1	0	9408	7/19/73	1210	8.2	23.3	12.1	4.4		0.1	0.12	0.0	0.021	0.05	0.03
5	2	122	1	0	9417	8/ 1/73	1511	8.2	23.8	8.3	4.3	15.	0.4	0.38	0.0	0.035	0.01	0.08
5	3	122	1	0	9428	8/16/73	1655	8.2	24.5	3.7	7.2	12.	3.1	1.00	2.1	0.010	0.00	0.33
5	4	122	1	0	9440	9/11/73	1715	8.1	20.5	6.2	1.0	8.	0.7	0.00	0.7	0.022	0.11	0.06
5	5	122	1	0	9451	9/12/73	1420	8.1	19.6	5.5	1.1	5.	1.4	0.12	1.3	0.027	0.16	0.06
5	6	122	1	0	9462	9/14/73	1000	8.1	18.4	6.1	2.4	14.	1.0	0.46	0.5	0.024	0.16	0.06
5	7	122	1	0	9477	9/27/73	1230	8.0	16.0	7.5	2.2	17.	0.2	0.25	0.0	0.019	0.14	0.10
5	8	122	1	0	9484	10/18/73	1800	7.9	15.2	7.8	2.0	3.	0.6	0.42	0.2	0.011	0.16	0.15
6	1	109	1	0	9406	7/19/73	1040	8.2	23.9	10.3	9.0		0.3	0.21	0.1	0.021	0.07	0.03
6	2	109	1	0	9416	8/ 1/73	1443	8.1	25.1	6.9	3.4	11.	0.4	0.27	0.1	0.025	0.03	0.11
6	3	109	1	0	9427	8/16/73	1630	8.6	25.9	7.2	3.2	15.	2.5	0.13	2.4	0.010	0.00	0.11
6	4	109	1	0	9439	9/11/73	1135	8.1	21.1	6.2	1.3	8.	0.5	0.11	0.4	0.022	0.10	0.03
6	5	109	1	0	9450	9/12/73	1530	8.2	20.5	6.4	22.0	4.	0.6	0.02	0.6	0.025	0.15	0.03
6	6	109	1	0	9461	9/14/73	1130	8.2	19.2	5.8	1.5	11.	0.5	0.00	0.5	0.024	0.15	0.06
6	7	109	1	0	9472	9/26/73	1830	8.0	15.3	9.3	2.4	14.	0.2	0.24	0.0	0.017	0.11	0.03
6	8	109	1	0	9483	10/18/73	1720	8.1	13.2	8.3	0.9	9.	0.6	0.43	0.2	0.022	0.22	0.09
7	1	91	2	0	9405	7/19/73	1017	8.3	24.0	8.3	2.4							
7	2	91	2	0	9415	8/ 1/73	1420	8.3	24.7	8.5	3.1							
7	3	91	2	0	9426	8/15/73	1545	8.6	25.4	7.5	3.1	25.	1.0	0.21	0.8			
7	4	91	2	0	9438	9/11/73	1110	8.1	21.2	5.9	1.6	15.	0.5	0.00	0.5	0.022	0.09	0.06
7	5	91	2	0	9449	9/12/73	1600	8.1	20.6	6.1	11.0	1.	0.5	0.00	0.5	0.022	0.12	0.03
7	6	91	2	10	13213	9/14/73	1200											
7	7	91	2	0	9471	9/26/73	1810	7.9	15.7	7.4	2.8	10.	0.5	0.40	0.1	0.018	0.11	0.06
7	8	91	2	0	9482	10/18/73	1700	8.0	13.3	8.9	2.0	7.	0.3	0.28	0.0	0.022	0.10	0.06
8	1	47	1	0	9401	7/18/73	1320	8.2	25.3	7.6	5.3	8.	0.6	0.55	0.1	0.030	0.09	0.39

GENESEE RIVER STUDY

STA	SMNC	MILE	CORP	TYPE	SAMP	CL	F	SO4	CN	PHENOL	AS	BA	CD	CR	CU	FE	HG	NI
4	7	147	2	0	9476	104.												
4	8	147	2	0	9488	169.												
5	1	122	1	0	9408	207.	0.00	83.		0.010	0.00	0.0	0.00	0.21	0.00	0.46	0.0000	0.0
5	2	122	1	0	9417	188.	0.08	145.	0.30	0.000	0.00	0.0	0.00	0.00	0.00	0.22	0.0010	0.1
5	3	122	1	0	9428	218.	0.00	170.	0.00	0.030	0.00	0.0	0.00	0.00	0.00	0.25	0.0038	0.0
5	4	122	1	0	9440	48.	0.00	76.	0.00	0.000	0.00	0.4	0.00	0.02	0.06	0.29	0.0009	0.0
5	5	122	1	0	9451	47.		84.				0.0	0.00	0.06	0.05	0.57		0.0
5	6	122	1	0	9462	52.		124.				0.4	0.00	0.04	0.04	0.26		0.0
5	7	122	1	0	9477	60.	0.00	107.	0.00	0.000	0.00	0.0	0.02	0.00	0.00	0.66	0.0110	0.0
5	8	122	1	0	9484	188.	0.12	138.	0.05	0.550	0.00	1.0	0.02	0.04	0.14	0.14	0.0046	0.0
6	1	109	1	0	9406	70.	0.00	128.		0.030	0.00	0.5	0.00	0.17	0.04	0.28		0.0
6	2	109	1	0	9416	117.	0.10	114.	0.10	0.000	0.00	0.0	0.00	0.00	0.00	0.40	0.0004	0.0
6	3	109	1	0	9427	120.	0.00	80.	0.00	0.040	0.00	0.0	0.00	0.00	0.00	0.23	0.0036	0.0
6	4	109	1	0	9439	37.	0.00	71.	0.01	0.000	0.00	0.4	0.00	0.00	0.03	0.37	0.0062	0.0
6	5	109	1	0	9450	38.		81.				0.0	0.00	0.02	0.00	0.48		0.0
6	6	109	1	0	9461	43.		99.				0.7	0.00	0.00	0.02	0.57		0.1
6	7	109	1	0	9472	103.	0.00	115.	0.00	0.000	0.00	0.4	0.03	0.00	0.00	0.15	0.0026	0.1
6	8	109	1	0	9483	105.	0.60	79.	0.00	0.050	0.00	0.7	0.00	0.00	0.12	0.29	0.0050	0.0
7	1	91	2	0	9405													
7	2	91	2	0	9415													
7	3	91	2	0	9426													
7	4	91	2	0	9438	38.		58.										
7	5	91	2	0	9449	38.												
7	6	91	2	10	13213													
7	7	91	2	0	9471	169.												
7	8	91	2	0	9482	83.												
8	1	47	1	0	9401	48.	0.04	36.	0.30	0.060	0.00	0.5	0.03	0.00	0.00	0.22		0.1

GENESEE RIVER STUDY

STA	SMNC	MILE	CORP	TYPE	SAMP	PB	SE	ZN	TS	VS	TSS	VSS	TDS	VDS
4	7	147	2	0	9476									
4	8	147	2	0	9488									
5	1	122	1	0	9408	0.0		0.048	392.0	110.0	96.0	64.0	296.0	46.0
5	2	122	1	0	9417	0.2	0.003	0.061	887.0	273.0	33.0	3.0	854.0	270.0
5	3	122	1	0	9428	0.0	0.003	0.025	775.0	125.0	11.4	5.7	763.6	119.3
5	4	122	1	0	9440	0.0	0.000	0.025	427.0	100.0	17.0	5.0	410.0	95.0
5	5	122	1	0	9451	0.7		0.035	510.0	158.0	64.0	5.0	446.0	153.0
5	6	122	1	0	9462	0.0		0.030	512.0	99.0	9.0	6.0	503.0	93.0
5	7	122	1	0	9477	0.0	0.003	0.060	308.0	120.0	23.3	2.7	284.7	117.3
5	8	122	1	0	9484	0.0	0.000	0.024	811.0	140.0	26.0	14.0	785.0	126.0
6	1	109	1	0	9406	0.0		0.088	492.0	100.0	72.0	52.0	420.0	48.0
6	2	109	1	0	9416	0.0	0.003	0.046	569.0	86.0	27.0	12.0	542.0	74.0
6	3	109	1	0	9427	0.0	0.003	0.030	467.0	82.0	130.0	56.0	337.0	26.0
6	4	109	1	0	9439	0.0	0.000	0.020	425.0	157.0	17.0	6.0	408.0	151.0
6	5	109	1	0	9450	0.0		0.030	332.0	40.0	16.0	5.0	316.0	35.0
6	6	109	1	0	9461	0.0		0.030	460.0	144.0	2.0	1.0	458.0	143.0
6	7	109	1	0	9472	0.0	0.003	0.090	396.0	144.0	44.7	4.0	351.3	140.0
6	8	109	1	0	9483	0.0	0.001	0.024	628.0	124.0	32.0	14.0	596.0	110.0
7	1	91	2	0	9405									
7	2	91	2	0	9415									
7	3	91	2	0	9426									
7	4	91	2	0	9438									
7	5	91	2	0	9449									
7	6	91	2	10	13213									
7	7	91	2	0	9471									
7	8	91	2	0	9482									
8	1	47	1	0	9401	0.7	0.000	0.036	536.0	320.0	88.0	44.0	448.0	276.0

GENESEE RIVER STUDY

STA	SMNO	MILE	CORP	TYPE	SAMP	DATE	TIME	PH	TEMPC	DO	BOD5	TOC	TKN	NH3N	ORGN	NO2N	NO3N	T-IP
8	2	47	1	0	9411	8/ 1/73	1015	8.3	26.6	5.5	5.7	1.	0.8	0.22	0.6	0.030	0.27	0.10
8	3	47	1	0	9425	8/16/73	1220	8.7	27.6	6.3	6.2	39.	1.9	0.86	1.0	0.020	0.00	0.16
8	4	47	1	0	9437	9/10/73	1345	8.0	23.1	6.8	1.0	15.	0.5	0.18	0.3	0.022	0.07	0.12
8	5	47	1	0	9448	9/13/73	1040	8.1	21.7	6.2	0.3	14.	0.2	0.06	0.1	0.028	0.13	0.06
8	6	47	1	10	13212	9/14/73	1200											
8	7	47	1	0	9467	9/26/73	1430	8.1	16.3	8.8	2.2	15.	0.2	0.17	0.0	0.023	0.10	0.06
8	8	47	1	0	9478	10/18/73	1315	8.1	14.3	8.9	2.1	6.	0.4	0.36	0.0	0.034	0.26	0.09
9	1	34	2	0	9402	7/18/73	1345	8.5	25.9	5.8	5.0							
9	2	34	2	0	9412	8/ 2/73	1045	7.1	24.9	4.9	5.0							
9	3	34	2	0	9424	8/15/73	1245	8.3	27.9	7.2	8.9	12.	1.9	0.81	1.1			
9	4	34	2	0	9436	9/10/73	1435	8.0	23.5	5.9	0.8	8.	1.4	0.51	0.9	0.022	0.06	0.12
9	5	34	2	0	9447	9/13/73	1100	8.2	22.6	6.0	3.5	15.	1.5	1.07	0.4	0.028	0.12	0.06
9	6	34	2	10	13211	9/14/73	1200											
9	7	34	2	0	9468	9/26/73	1515	8.1	16.7	8.0	2.8	10.	0.5	0.49	0.0	0.025	0.13	0.09
9	8	34	2	0	9479	10/18/73	1400	7.9	15.9	8.9	1.5	1.	2.1	1.88	0.2	0.029	0.18	0.09
10	1	22	2	0	9403	7/18/73	1415	7.9	26.0	5.0	4.9							
10	2	22	2	0	9413	8/ 2/73	1113	7.5	25.9	4.5	4.1							
10	3	22	2	0	9423	8/15/73	1310	8.2	27.2	3.4	6.0	3.	1.0	1.03	0.0			
10	4	22	2	0	9435	9/10/73	1505	8.1	23.5	5.4	1.1	10.	0.9	0.33	0.6	0.024	0.05	0.22
10	5	22	2	0	9446	9/13/73	1145	8.2	22.8	5.3	2.2	15.	2.0	1.22	0.8	0.028	0.12	0.11
10	6	22	2	10	13210	9/14/73	1200											
10	7	22	2	0	9469	9/26/73	1540	8.0	17.3	8.1	2.6	12.	1.9	0.57	1.3	0.028	0.13	0.06
10	8	22	2	0	9480	10/18/73	1440	7.9	15.2	6.8	2.6	5.	1.5	1.17	0.3	0.034	0.23	0.09
11	1	7	1	0	9404	7/18/73	1502	8.1	24.4	6.0	5.0		0.9	0.80	0.1	0.037	0.07	0.11
11	2	7	1	0	9414	8/ 1/73	1143	8.4	22.9	3.9	3.2	1.	1.2	0.96	0.2	0.023	0.01	0.07
11	3	7	1	0	9422	8/16/73	1331	8.1	26.0	4.3	6.2	16.	1.9	0.68	1.2	0.020	0.01	0.02
11	4	7	1	0	9434	9/10/73	1540	8.2	23.2	5.1	1.6	7.	0.7	0.00	0.7	0.030	0.07	0.31
11	5	7	1	0	9445	9/13/73	1200	8.3	22.9	4.1	0.9	16.	2.6	2.15	0.5	0.029	0.13	0.11
11	6	7	1	10	13209	9/14/73	1200											
11	7	7	1	0	9470	9/26/73	1615	8.0	15.8	8.7	2.8	13.	1.2	0.68	0.5	0.028	0.12	0.05

GENESEE RIVER STUDY

STA	SMNO	MILE	CORP	TYPE	SAMP	CL	F	SO4	CN	PHENOL	AS	BA	CD	CR	CU	FE	HG	NI
8	2	47	1	0	9411	57.	0.12	171.	0.00	0.150	0.00	0.0	0.03	0.00	0.03	0.31	0.0000	0.0
8	3	47	1	0	9425	99.	0.00	92.	0.00	0.020	0.00	0.0	0.00	0.00	0.00	0.48	0.0056	0.0
8	4	47	1	0	9437	46.	0.00	51.	0.00	0.060	0.00	0.0	0.00	0.04	0.04	0.14	0.0053	0.0
8	5	47	1	0	9448	42.		64.				0.7	0.00	0.02	0.00	0.11		0.0
8	6	47	1	10	13212													
8	7	47	1	0	9467	59.	0.00	109.	0.00	0.000	0.00	0.0	0.00	0.00	0.00	0.40	0.0036	0.0
8	8	47	1	0	9478	96.	0.00	64.	0.00	0.030	0.00	1.4	0.01	0.00	0.12	0.09	0.0036	0.0
															.19			
															.31			
9	1	34	2	0	9402													
9	2	34	2	0	9412													
9	3	34	2	0	9424													
9	4	34	2	0	9436	52.												
9	5	34	2	0	9447	47.												
9	6	34	2	10	13211													
9	7	34	2	0	9468	60.												
9	8	34	2	0	9479	104.												
10	1	22	2	0	9403													
10	2	22	2	0	9413													
10	3	22	2	0	9423													
10	4	22	2	0	9435	59.												
10	5	22	2	0	9446	47.												
10	6	22	2	10	13210													
10	7	22	2	0	9469	57.												
10	8	22	2	0	9480	95.												
11	1	7	1	0	9404	42.	0.00	115.		0.050	0.00	0.5	0.00	0.50	0.03	1.12		0.0
11	2	7	1	0	9414	63.	0.12	46.	0.10	0.020	0.00	0.0	0.00	0.00	0.02	0.59	0.0022	0.1
11	3	7	1	0	9422	66.	0.00	76.	0.03	0.020	0.00	0.0	0.00	0.00	0.05	0.38	0.0036	0.1
11	4	7	1	0	9434	63.	0.01	83.	0.00	0.020	0.00	0.0	0.00	0.00	0.02	0.23	0.0035	0.3
11	5	7	1	0	9445	52.		88.				0.0	0.00	0.06	0.02	0.34		0.0
11	6	7	1	10	13209													
11	7	7	1	0	9470	47.	0.00	108.	0.00	0.000	0.00	0.4	0.03	0.00	0.00	0.15	0.0020	0.0

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                              GENESEE RIVER STUDY

 STA  SMNC  MILE  CORP  TYPE   SAMP   PB     SE     ZN      TS     VS    TSS   VSS    TDS    VDS
 ---  ----  ----  ----  ----  -----  ---  -----  -----  ------  -----  -----  ----  ------  -----
   8     2    47     1     0   9411  0.0  0.002  0.051   423.0   74.0   11.0   5.0   412.0   69.0
   8     3    47     1     0   9425  0.0  0.002  0.095   470.0  147.0   46.0  30.0   424.0  117.0
   8     4    47     1     0   9437  0.0  0.000  0.000   343.0   35.0   15.0   3.0   328.0   32.0
   8     5    47     1     0   9448  0.0         0.030   372.0   45.0    6.0   2.0   366.0    4.3
   8     6    47     1    10  13212
   8     7    47     1     0   9467  0.0  0.001  0.095   388.0  200.0   42.7   8.0   345.3  192.0
   8     8    47     1     0   9478  0.0  0.003  0.024   600.0  144.0   56.0  16.0   544.0  128.0

   9     1    34     2     0   9402
   9     2    34     2     0   9412
   9     3    34     2     0   9424
   9     4    34     2     0   9436
   9     5    34     2     0   9447
   9     6    34     2    10  13211
   9     7    34     2     0   9468
   9     8    34     2     0   9479

  10     1    22     2     0   9403  0.6
  10     2    22     2     0   9413
  10     3    22     2     0   9423
  10     4    22     2     0   9435
  10     5    22     2     0   9446
  10     6    22     2    10  13210
  10     7    22     2     0   9469
  10     8    22     2     0   9480

  11     1     7     1     0   9404  0.0         0.098   244.0  100.0   48.0  32.0   196.0   68.0
  11     2     7     1     0   9414  0.0  0.002  0.046   443.0   95.0  108.0  12.0   335.0   83.0
  11     3     7     1     0   9422  0.0  0.004  0.050   317.0   53.0   36.0  18.4   281.0   34.6
  11     4     7     1     0   9434  0.0  0.000  0.025   447.0   42.0   19.0   7.0   428.0   35.0
  11     5     7     1     0   9445  0.0         0.038   440.0   80.0    2.0   1.0   438.0   79.0
  11     6     7     1    10  13209
  11     7     7     1     0   9470  0.0  0.004  0.125   304.0  188.0   25.4   3.3   278.6  184.7
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GENESEE RIVER STUDY

STA	SMNC	MILE	CORP	TYPE	SAMP	DATE	TIME	PH	TEMPC	DO	BOD5	TOC	TKN	NH3N	ORGN	NO2N	NO3N	T-IP
11	8	7	1	0	9481	10/18/73	1515	7.6	15.5	6.2	2.7	3.	2.6	1.85	0.8	0.042	0.29	0.12
101	2	34	1	0	9383	8/ 2/73	1030				16.0	-1.	2.2	1.05	1.2	0.071	0.64	0.05

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                                         GENESEE RIVER STUDY

STA   SMNC  MILE  CORP  TYPE   SAMP   CL     F     SO4    CN     PHENOL    AS    BA   CD    CR    CU    FE     HG     NI
----  ----  ----  ----  ----  -----  ----  ----  ----  ----   --------  ----  ---  ----  ----  ----  ----  ------  ---
  11     8     7     1     0   9481  133.  0.00  101.  0.05      0.000  0.00  1.0  0.02  0.00  0.16  1.00  0.0058  0.0

 101     2    34     1     0   9383   57.  0.20   33.  4.30      0.080  0.00  0.5  0.03  0.00  0.09  0.53  0.0150  0.0
```

GENESEE RIVER STUDY

STA	SMNC	MILE	CORP	TYPE	SAMP	PB	SE	ZN	TS	VS	TSS	VSS	TDS	VDS
11	8	7	1	0	9481	0.0	0.001	0.014	712.0	116.0	60.0	14.0	652.0	102.0
1C1	2	34	1	0	9383	0.0		0.091	513.0	115.0	184.0	68.0	329.0	47.0

APPENDIX C - BIOLOGICAL ASSAYS CONDUCTED ON THE GENESEE RIVER

DESCRIPTION OF FISH IN GENESEE RIVER

CLUPIDAE

Alewife (Alosa pseudoharengus)

In Lake Ontario, the alewife spawns at night in late May to early July or may begin in April with a peak in mid-June to early July (52). The temperature range for spawning appears to be 13 to 16°C (55.4 to 60.8°F)(53). The adults migrate to spawn in streams or shallow water areas along the shore, spawning on sand or gravel bottoms, often in areas with some vegetation. The female lays anywhere from 11,000 to 22,400 eggs(54). The incubation period ranges from 48 to 96 hours at 22°C (71.6°F) to six days at 15.5°C (59.9°F)(55). The fry are positively phototrophic and pelagic(56) and during the fall and winter after hatching, move to the mid-depths of the lake where they remain until about their third summer, at which time they move to the bottom(57,58).

After one year's growth, they measure 138.6 mm in total length.

Alewife males usually mature at the age of two and the females at the age of three(53). As adults, alewives feed mainly on the larger plankton (copepods and cladocerans), and young alewives have been observed feeding on alewife eggs during the spawning period.

In mid-winter, the adults are densely concentrated on the bottom in the deepest areas of a lake, where they may be seeking the warmest waters(57,58), as the preferred temperature range at this period is 4.4 to 8.8°C (39.9 to 47.8°F)(59). As spring approaches, they begin moving closer to shore. The average life span is about four years with death occurring shortly after spawning.

At the time of spawning, temperature preferendum is about 20°C (68°F) but this declines after spawning to 16 to 17°C (60.8 to 62.6°F). After spawning, the alewives generally move offshore and disperse from the surface to deeper depths.

CATOSTOMIDAE

White sucker (Catostomus commersoni)

The white sucker migrates from lakes and large rivers to swift streams of relatively small size in April to May for spawning(60). The female will lay approximately 67,000 to more than 100,000 eggs. The incubation period is variable with temperature. Bassett,(61), found the incubation period to be five days at 18°C (64.4°F), seven days at 15.5 to 16.1°C (49.9 to 61.0°F) and 11 days at 13.6°C (56.5°F).

Most major zooplankton groups present form food for the larvae fish (rotifers, copepods, etc.). Cladocerans increase in the diet after fish reach 1.4 cm in total length(62). The post larval fish occur most abundantly over the terrigenous shoals of lakes, schooling off the bottom, in shallow water near the beach(60).

At the end of the first growing season, total length will average 10.2 to 17.7 cm. They slowly move off the terrigenous shoals into the shallow shoreward vegetation, schooling closer to the bottom feeding on bottom detritus. Young suckers also utilize entomostracans, small insects, rotifers, and algae.

Adults prefer amphipods, fingernail clams, snails, detritus, chiromonids, and entomostracans. They are almost strictly benthic dwellers. It is very rare to catch a sucker in a net set near the surface, as opposed to a bottom net.

White suckers vary greatly in the time it takes to reach maturity, taking from three to seven years depending on the locality and conditions.

The white sucker prefers a temperature range from 14.1°C to 21.6°C (57.3° to 64.9°F)(63,59).

The LD is 30°C (86°F) and 31.1°C (88°F) when acclimated to 7.2°C (45°F) and 10.0°C (50°F) respectively(63).

Numbers in the area along the shore of Lake Ontario have always been low and they have comprised only a few percent of total gill net catches.

ICTALURIDAE

Brown bullhead (Ictalurus nebulosus)

The brown bullhead spawns early in the spring, late April or May. A fanned-out depression in mud serves as a nest into which 2,000 to 10,000 or more eggs are deposited. The parents guard the nest during the incubation period, which is usually from five to eight days. After hatching, they are herded about in schools for some weeks(64). Juvenile bullheads feed mainly on ostracods and copepods, with tendipides larva also a factor(65). At the end of the first year, they reach a length of about 6.3 to 10.2 cm.

Brown bullheads mature in about three years. At this stage in the adult life, the main foods are crustaceans, snails, small crayfish, worms and small clams. Traveling in schools and feeding off the bottom, they will feed eagerly on nearly anything available, living or dead.

Bullheads can grow in weight to about two pounds (900 grams), but most will average from eight to ten in. and weigh less than one pound (450 grams)(64).

Adults, when acclimated to 7.2°C (45°F) and 11.1°C (52°F), have relatively high LDs of 33.9°C (93°F) and 36.1°C (97°F), respectively(63). They have been observed swimming in 37 to 38°C (98.6 to 100.4°F) water and would enter 40°C (104°F) water for worms(66).

At the winter temperature of 4.0°C (49.2°F) or below, very little feeding occurs, but at 6.5°C (43.7°F) feeding again begins(67). Brown bullheads can bury themselves in mud under adverse conditions, (e.g., toxicity) and emerge later when conditions are more favorable.

SERRANIDAE

White perch (Roccus americana)

The white perch spawns over a period of several days in late May, June and July. Sometime at night, the female lays about 40,000 eggs in long strips over sand or gravel bars(68). The eggs sink to the bottom and stick firmly to any substrate. At 17.2°C (63.0°F) the eggs hatch, in about 48 hours, forming larval fry 2.6 mm long. These newly hatched fry feed on plankton and are usually found along the shore in quiet areas. By the end of the first summer they range from 6.4 to 10.2 cm in length and average 8.9 cm at the end of the first year. These young are found in large numbers in weedy areas along the shore of lakes and rivers, and in clear waters of lakes at depths of about 2.5 to four meters over mud bottoms in July(69,70).

The adults are generally found in three to six meters of water in lakes and move inshore at night to feed. They generally feed on insect larvae (mayfly, midge), amphipods, insects and smaller fish. The major constituent, however, is Gammarus, the freshwater scud(69,70). Alewives and spottail shiners comprise just under half the food supply in the spring. By July, alewives supply over three quarters of the food utilized. In August, over 80 percent of the food consists of Gammarus gradually reverting in the fall to alewives and Gammarus as the two major sources.

The white perch seems to do best in water at 23.9°C (75°F), or somewhat higher(71).

The maximum age is about 15 years in New York State, reaching 1360 to 2000 grams in uncrowded lake conditions.

CENTRARCHIDAE

The family Centrarchidae have four major representatives in the inshore ichthyofauna of Lake Ontario. Of these the smallmouth bass is the most important (for sport fisher), while the bluegill and pumpkinseed sunfish are the most numerous of the panfish. Rock bass are also present but have not been taken or seen in large numbers.

Smallmouth bass (Micropterus dolomieui)

Smallmouth bass reproduce during the first ten days or two weeks in May. Migration up small tributary streams to spawn is very common. The actual spawning activities commence when the water temperature reaches 15.6°C to 18.3°C (60 to 65°F). The males construct nests on gravel, coarse sand, or rock by fanning out shallow depressions.

The number of eggs varies greatly, from 200 to several thousand, depending on how many females have used one nest. Respawning (in both sexes) and renesting is a common occurrence. There is no evidence of spawning along the lake shore.

The eggs hatch in three to five days. After six to 15 days, they leave the nest and begin feeding on crustaceans(64). At 23.9°C (75°F), the mean incubation period was about two and one-quarter days(63). By the end of the first fall, they reach a length of 7.6 to 10.2 cm total length(64).

Smallmouth bass mature in the second or third year of life. They can reach a size of 2200 to 2700 grams, but the maximum for the average fish is 1300 to 1800 grams. Food for the adult consists of alewives, small fish, and crayfish. Wagner(72) found Gammarus, sculpin and alewife eggs to be major foods, while crayfish and alewives were a lesser food.

Rock bass (Ambloplites rupestris)

Rock bass spawn in late April to mid-June when the water temperature reaches 20.6 to 21.1°C (69 to 70°F). The male forms a nest, guarding and fanning the 3000 to 8500 eggs the female lays(70).

By the end of the first growing season, the young are between 3.8 to 5.1 cm long. The young rock bass eat insects and crayfish(70).

The adult rock bass feeds primarily on crayfish, with small fish and large insects supplying the bulk of the rest of their diet. The maximum length usually attained is 16.5 cm. The rock bass matures as early as the fourth year of life or as late as the seventh year(70).

The rock bass will begin to feed in the spring of the year when the water temperature reaches 9.5°C (49.1°F) according to Keast(67). The preferred temperature range is between 14.7°C and 21.3°C (58.4°F to 70.3°F). When acclimated to 7.2°C (45°F) and 23.9°C (75°F), the LDs are 29.4°C (85°F) and 37.5°C (99.5°F) respectively(63).

In the spring, rock bass are migrating along the shore of the lake. They appear to settle down in one area during the summer but actively migrate in the fall and winter.

PERCIDAE

Yellow perch (perca flavescens)

Yellow perch spawn in April and early May, approximately when the temperature reaches a range of 6.7 to 12.2°C (44 to 54°F). The eggs are deposited in accordion-like gelatinous ribbons on sand, gravel, or sometimes on vegetation in near shore areas five to ten ft. deep. The number of eggs laid by one female ranges from 24,000 to 48,000, depending mainly upon the size of the female. The eggs hatch in 48 hours at 17.2°C (63°F) and average 5.8 mm in total length at this time(70). Generally, if the incubation water temperature in somewhat raised, the incubation period shortens. Thus, in the previously mentioned spawning temperature range, the incubation period probably is slightly longer.

At the initiation of feeding, yellow perch favor Copepod nauplia and rotifers. As they grow eight to eleven cm, cyclopoid copepods dominate, with cladocera gradually becoming the main food after that(62).

After one year's growth, yellow perch reach a size of about 70 mm and their diet expands to include various crustaceans, insects and small fish. These fingerlings seem to prefer a 23.9°C (75°F) water temperature. In the second year of life and onward, the preferred temperature drops to 21.1°C (70°F)(70). When acclimated to 8.0°C (46.4°F), they prefer a mean temperature of 18.6°C (65.4°F). When the acclimation temperature rises to 10.0°C (50°F), the preferred temperature is 20.4°C (68.7°F)(63). The LD was found to be 29.7°C (85.5°F) when acclimated to 25.0°C (77°F).

Yellow perch may live for eight to nine years, reaching a size of 30.5 cm and weighing 460 grams. These larger fish in Lake Ontario eat Gammarus, sculpins, darters, alewives and their roe, and the spottail minnows. The same should be true of populations in the Genesee River. The major food depends on the availability of each food, which is either seasonal or related to population cycles.

Netting studies have shown that yellow perch come into shore areas to feed at night, probably moving back to about six to seven meter depth during the daytime.

In the food chain, yellow perch serve as a large portion of the food of walleyes, smallmouth bass, northern pike, and crappies.

TABLE 1. Table of $\log_{10} N/\alpha$ in terms of $\log_{10} N/S$, for solving the equation

$$S = \alpha \log_e \left(1 + \frac{N}{\alpha}\right)\text{, given } S \text{ and } N$$

$\log_{10} N/S$	0	1	2	3	4	5	6	7	8	9
0·4	0·61121	63084	65023	66939	68832	70701	72551	74382	76195	77990
0·5	0·79706	81520	83271	85002	86717	88417	90105	91779	93442	95092
0·6	0·96730	98356	99973	1·01579	03174	04759	06335	07902	09460	11010
0·7	1·12550	14220	15813	17331	18772	20136	21631	23120	24602	26077
0·8	1·27540	29008	30465	31916	33361	34801	36234	37663	39087	40506
0·9	1·41920	43329	44733	46133	47528	48919	50305	51688	53066	54440
1·0	1·55810	57177	58539	59898	61254	62605	63954	65299	66640	67979
1·1	1·69314	70646	71975	73301	74623	75943	77261	78575	79886	81195
1·2	1·82501	83805	85106	86404	87700	88994	90285	91574	92860	94144
1·3	1·95426	96706	97984	99259	2·00532	01804	03073	04340	05605	06869
1·4	2·08130	09389	10647	11902	13156	14409	15659	16908	18155	19400
1·5	2·20644	21886	23126	24365	25602	26838	28072	29305	30536	31766
1·6	2·32994	34221	35446	36670	37893	39114	40334	41553	42770	43986
1·7	2·45201	46414	47627	48838	50048	51256	52464	53670	54875	56079
1·8	2·57282	58484	59684	60884	62083	63280	64476	65672	66866	68059
1·9	2·69252	70443	71633	72822	74011	75198	76385	77570	78755	79939
2·0	2·81121	82303	83484	84664	85843	87022	88199	89376	90552	91727
2·1	2·92901	94075	95247	96419	97590	98760	99930	3·01099	02267	03434
2·2	3·04600	05766	06931	08095	09259	10422	11584	12745	13906	15066
2·3	3·16225	17384	18542	19699	20856	22012	23168	24323	25477	26630
2·4	3·27783	28936	30087	31238	32389	33539	34688	35837	36985	38133
2·5	3·39280	40426	41572	42717	43862	45006	46150	47293	48436	49578
2·6	3·50719	51860	53001	54141	55280	56419	57558	58696	59833	60970
2·7	3·62106	63242	64378	65513	66648	67782	68915	70048	71181	72313
2·8	3·73445	74577	75707	76838	77968	79097	80227	81355	82484	83611
2·9	3·84739	85866	86992	88119	89244	90370	91495	92619	93743	94867
3·0	3·95991	97114	98236	99358	4·00480	01602	02723	03843	04964	06084
3·1	4·07203	08322	09441	10560	11678	12795	13913	15030	16147	17263
3·2	4·18379	19494	20610	21725	22839	23954	25068	26181	27295	28408
3·3	4·29520	30632	31744	32856	33967	35079	36189	37300	38410	39520
3·4	4·40629	41738	42847	43956	45064	46172	47280	48387	49494	50601
3·5	4·51707	52814	53920	55025	56131	57236	58340	59445	60549	61653

TABLE 2
Genesee River
Plankton Abundance and Composition
July 18-19, 1973
Number of organisms/liter

Station Sample Number	1 No Sample	3 No Sample	5 9408-S	6 No Sample	8 No Sample	11 9404-S
Organism						
Phytoplankton						
Diatoms:						
Asterionella						52
Fragilaria						52
Synedra						464
Melosira			52			310
Cyclotella			52			258
Navicula						52
Gyrosigma			52			
Blue-greens:						
Oscillatoria			52			52
Green:						
Pediastrum			464			2219
Scenedesmus			413			258
Mougeotia						52
Actinastrum			206			103
Other:						
Cryptomonas			52			
Zooplankton						
Rotifers:						
Keratella			103			155
Brachionus						671
Polyarthra						52

TABLE 2
Genesee River
Plankton Abundance and Composition
July 18-19, 1973
Number of organisms/liter

Station	1	3	5	6	8	11
Sample Number	No Sample	No Sample	9408-S	No Sample	No Sample	9404-S
Organism						
Phytoplankton						
Diatoms:						
Asterionella						52
Fragilaria						52
Synedra						464
Melosira			52			310
Cyclotella			52			258
Navicula						52
Gyrosigma			52			
Blue-greens:						
Oscillatoria			52			52
Green:						
Pediastrum			464			2219
Scenedesmus			413			258
Mougeotia						52
Actinastrum			206			103
Other:						
Cryptomonas			52			
Zooplankton						
Rotifers:						
Keratella			103			155
Brachionus						671
Polyarthra						52

TABLE 2

Station	1	3	5	6	8	11
Sample Number	No Sample	No Sample	94-8-S	No Sample	No Sample	9404-S
Organism						
Protozons:						
Norticella						103
Nauplii						52
Cladocera:						
Bosmiana						52
Total number/liter			1446			4905

TABLE 3
Genesee River
Plankton Abundance and Composition
July 18-19, 1973

Number of organisms/liter

Station	1	3	5	6	8	11
Sample Number	No Sample	No Sample	9408-B	No Sample	No Sample	9404-B
Organism						
Phytoplankton						
Diatoms:						
Asterionella						52
Fragilaria			52			155
Synedra			103			52
Melosira						155
Cyclotella			52			
Navicula						155
Blue-greens:						
Anabaena						52
Oscillatoria			103			103
Green:						
Pediastrum			155			1858
Staurastrum			52			103
Scenedesmus						52
Coelastrum						52
Mougeotia						258
Closteriopsis						103
Actinastrum			52			
Zooplankton						
Rotifers:						
Keratella						258
Brachionus			103			103

TABLE 3

Station	1	3	5	6	8	11
Sample Number	No Sample	No Sample	9408-B	No Sample	No Sample	9404-B
Organism						
Copepods:						
Cydopiod						52
Nauplii						52
Cladocerans						
Cladocerans:						
Bosmina						103
Daphnia						52
Protozoans:						
Difflugia						206
Vorticella			52			
Eudorina			52			
Total Number/liter			776			3976

TABLE 4
Genesee River
Plankton Abundance and Composition
August 1-2, 1973
Number of organisms/liter

Station	1	3	5	6	8	11
Sample Number	9419-S	9421-S	9417-S	9416-S	9411-S	9414-S
Organism						
Phytoplankton						
Diatoms:						
Asterionella			40			
Tabellaria			408			
Fragilaria	52	52		1909	774	619
Synedra	413		81	412	206	310
Melosira	155	103	204	11042	619	516
Navicula	155	52	81	52	103	52
Gyrosigma	155	206	408			
Surirella		52				
Meridion	103					
Blue-greens:						
Oscillatoria	155		204	52	52	258
Merismopedia				52		
Gloeocapsa		52	90	52		
Green:						
Pediastrum	103	103	258	3560	2322	1496
Staurastrum	103			774	103	
Scenedesmus		52	163	722	464	774
Cosmarium		52				
Euderina			122		52	
Schroederia			489	103	52	
Mougeotia				258		
Closteriopsis			81			

TABLE 4

Station	1	3	5	6	8	11
Sample Number	9419-S	9421-S	9417-S	9416-S	9411-S	9414-S
Organism						
Green, Con't.						
Pleodorina				309	1187	774
Microspora			40			
Closterium	52				155	52
Cladaphora	52					
Characiopsis	52	103		206	103	464
Actinastrum				1342	52	826
Pyrrhophyta:						
Ceratium	52			206	103	103
Other:						
Phacus				51		52
Dinobyron			40			
Zooplankton						
Rotifers:						
Kellicotia					361	
Keratlla		52		155		413
Polyarthra				206	155	361
Pleosoma			40			
Brachionus		52	52			103
Copepods:						
Nauplii	52					52
Total number/liter	1654	931	2751	21463	6863	7225

TABLE 5
Genesee River
Plankton Abundance and Composition

August 1-2, 1973
Number of organisms/liter

Station	1	3	5	6	8	11
Sample Number	9419-B	9421-B	No Sample	9416-B	9411-B	9414-B
Organism						
Phytoplankton						
Diatoms:						
Asterionella		816				
Tabellaria		408		52		
Fragilaria				2528	1449	722
Synedra	103	204		256	103	670
Melosira	310	408		8049	258	464
Cyclotella		408				
Navicula	464	204				671
Gyrosigma	361	4896			52	
Pleurosigma		408				
Meridion	103					52
Diploneis-				52		
Blue-greens:						
Anabaena	52	408				52
Anacystis		408				
Spirulina				103		
Oscillatoria	206	3264		361	206	361
Gloeocapsa				52		
Green:						
Pediastrum	361	204		3096	2374	2219
Staurastrum	52			567	155	155
Scenedesmus	206	2448		671	155	258

TABLE 5

Station	1	3	5	6	8	11
Sample Number	9419-B	9421-B	No Sample	9416-B	9411-B	9414-B
Organism						
Green, Con't.						
Schroederia		1632		155		
Mougeotia	52	408		516	258	155
Microspora		1632				
Closterium	155			52	103	103
Characiopsis				206	361	722
Actinastrum	206			929	52	103,
Pyrrhophyta:						
Ceratium				206	413	258
Other:						
Phacus					52	52
Zooplankton						
Rotifers:						
Kellicottia					103	
Keratella				258	258	52
Polyarthra				103	52	
Brachionus	40			258	206	
Protozoans:						
Oocticella		52				
Difflugia						52
Copepods:						
Cyclopoid						103
Nauplii						206
Total number/liter	2671	18208		18522	6352	7378

TABLE 6
Genesee River
Plankton Abundance and Composition

August 15-16, 1973
Number of organisms/liter

Station	1	3	5	6	8	11
Sample Number	No Sample	No Sample	9428-S	No Sample	No Sample	No Sample
Organism						
Phytoplankton						
Diatoms:						
Gyrosigma			1449			
Green:						
Pediastrum			14448			
Scenedesmus			50568			
Closterium			1032			
Characiopsis			2683			
Pyrrhophyta:						
Ceratium			1449			
Other:						
Phacus			619			
Zooplankton			—			
Total number/liter			72248			

TABLE 7
Genesee River
Plankton Abundance and Composition

August 15-16, 1973
Number of organisms/liter

Station Sample Number	1 No Sample	3 No Sample	5 9428-B	6 No Sample	8 No Sample	11 No Sample
Organism						
Phytoplankton						
Diatoms:						
Synedra			6605			
Navicula			3302			
Green:						
Pediastrum			48163			
Scenedesmus			102374			
Closterium			2477			
Characiopsis			2477			
Actinastrum			3302			
Zooplankton			—			
Total number/liter			168700			

TABLE 7
Genesee River
Plankton Abundance and Composition

September 10-11, 1973
Number of organisms/liter

Station	1	3	5	6	8	11
Sample Number	9444-S	9442-S	9440-S	No Sample	No Sample	No Sample
Organism						
Phytoplankton						
Diatoms:						
Asterionella	52					
Tabellaria	52					
Fragilaria	52	408				
Synedra	103	816	103			
Melosira		408	258			
Navicula	52	2448				
Gyrosigma		408	103			
Blue-greens:						
Oscillatoria		816	52			
Green:						
Pediastrum	52					
Staurastrum	103		52			
Scenedesmus		408				
Mougeotia	155	4896	929			
Zooplankton	—	—	—			
Total number/liter	621	10608	1497			

TABLE 8

Genesee River
Plankton Abundance and Composition

September 10-11 1973
Number of organisms/liter

Station	1	3	5	6	8	11
Sample Number	9444-B	9442-B	9440-B (partial)	No Sample	No Sample	No Sample
Organism						
Phytoplankton						
Diatoms:						
Asterionella	52	408				
Tabellaria		816				
Fragilaria	52	816	103			
Synedra	52	408	52			
Melosira		408	774			
Navicula		204				
Gyrosigma		408				
Blue-greens:						
Anabaena		408				
Oscillatoria	52	204	42			
Green:						
Pediastrum		408	52			
Staurastrum			52			
Gonium			408			
Mougeotia		1224				
Characiopsis			52			
Zooplankton	—	—	—			
Total number/liter	208	6120	1137			

TABLE 9
Genesee River
Plankton Abundance and Composition

September 12-13, 1973
Number of organisms/liter

Station	1	3	5	6	8	11
Sample Number	9455-S	9453-S	9451-S	9450-S	No Sample	9445-S
Organism						
Phytoplankton						
Diatoms:						
Asterionella		40				
Fragilaria		40		516		81
Synedra	52		52			163
Melosira	52	298	103			
Cyclotella			52			163
Navicula	52	81				163
Gyrosigma	103		103	155		
Stephanodiscus		81				
Meridion				52		
Blue-greens:						
Anabaena		40				
Microcystis						40
Oscillatoria		204	103	103		81
Greens:						
Pediastrum	52		155	774		652
Staurastrum				40		
Scenedesmus				52		40
Hydrodictyon	52					

TABLE 9

Station Sample Number	1 9455-S	3 9453-S	5 9451-S	6 9450-S	8 No Sample	11 9445-S
Organism						
Green, Con't.						
Schroederia		40				
Mougeotia	52	481	877	722		1469
Closteriopsis				155		40
Microspora		81				285
Closterium				52		
Cladaphora		40				
Characiopsis			103	103		
Other:						
Phacus			52			
Zooplankton						
Rotifers:.						
Keratella				361		40
Brachionus				52		
Total Number/liter	415	728	1755	3200		3257

TABLE 10
Genesee River
Plankton Abundance and Composition
September 12-13, 1973
Number of organisms/liter

Station	1	3	5	6	8	11
Sample Number	9455-B	9453-B	9451-B	9450-B	No Sample	9445-B
Organism						
Phytoplankton						
Diatoms:						
Asterionella	52	41		52		
Fragilaria			82	258		103
Synedra	103	204	652			103
Melosira	52	41	245			361
Cyclotella	52					
Navicula		163	1102			103
Gyrosigma	52		816			
Blue-greens:						
Oscillatoria		41	857			
Gloeocapsa						155
Green:						
Pediastrum			82	103		774
Staurastrum	52					
Scenedesmus			41			103
Gonium		41	163			
Mougeotia	309	368	2446	258		1238
Closteriopsis			82			361
Microspora			775			
Characiopsis						206
Other:						
Phacus	52					

TABLE 10

Station	1	3	5	6	8	11
Sample Number	9455-B	9453-B	9451-B	9450-B	No Sample	9445-B
Organism						
Zooplankton						
Rotifers:						
Keratella						52
Brachionus						155
Polyarthra						103
Peotozoans:						
Paramecium						52
Total Number/liter	724	858		7343		3869

TABLE 11

Genesee River
Plankton Abundance and Composition
September 13-14, 1973
Number of organisms/liter

Station Sample Number	1 9466-S	3 No Sample	5 No Sample	6 No Sample	8 No Sample	11 No Sample
Organism						
Phytoplankton						
Diatoms:						
Asterionella	258					
Fragilaria	52					
Synedra	155					
Navicula	155					
Gyrosigma	103					
Blue-greens:						
Oscillatoria	103					
Green:						
Pediastrum	155					
Staurastrum	52					
Mougeotia	774					
Netrium	52					
Characiopsis	52					
Zooplankton						
Protozoans:						
Chrysopyxis	52					
Total Number/liter	1705					

TABLE 12
Genesee River
Plankton Abundance and Composition
September 13-14, 1973
Number of organisms/liter

Station	1	3	5	6	8	11
Sample Number	9466-B	No Sample	No Sample	No Sample	No Sample	No Sample
Organism						
Phytoplankton						
Diatoms:						
Asterionella	706					
Synedra	103					
Navicula	206					
Gyrosigma	103					
Green:						
Mougeotia	885					
Total Number/liter	2003					

TABLE 13
Genesee River
Plankton Abundance and Composition

Number of organisms/liter

Station Sample Number	1 9473-S	3 9475-S	5 9477-S	6 7472-S	8 7467-S	11 9470-S
Organism						
Phytoplankton						
Diatoms:						
Asterionella		155		52		52
Tabellaria	103		103		155	155
Fragilaria	516	52	464	1651	1083	619
Synedra		208	103	206	52	
Melosira	52	52			155	52
Cyclotella		52				
Navicula	52	153	103	52	52	
Blue-greens:						
Anacystis		52		52	155	
Spirulina		52		52		
Oscillatoria					52	52
Green:						
Pediastrum	310	412	206	516	877	929
Staurastrum	206			52		103
Spirogyra	52					
Chaetophora	206			52	155	
Sphaeroplea						155
Trochiscia				52		
Mougeotia		208	52	206	258	310
Closteriopsis	258	103	155	258	310	155
Netrium					52	

TABLE 13

Station Sample Number	1 9473-S	3 9475-S	5 9477-S	6 9472-S	8 9467-S	11 9470-S
Organism						
Green, Con't.						
Characiopsis			155			
Actinastrum		52			52	
Pyrrhophyta						
Ceratium				52	103	
Peridinium			52			
Other:						
Phacus		52	103			155
Zooplankton						
Rotifers:						
Kellicottia	52		52	52		
Keratella	52		52		52	52
Polyarthra						52
Protozoans						
Chrysacoccus	52					
Difflugia				52		
Total Number/liter	1911	1603	1600	3357	3563	2841

TABLE 14
Genesee River
Plankton Abundance and Composition
September 26-27, 1973
Number of organisms/liter

Station Sample Number	1 9477-B	3 9475-B	5 9473-B	6 9472-B	8 9467-B	11 9470-B
Organism						
Phytoplankton						
Diatoms:						
Asterionella						155
Tabellaria	103		103			52
Fragilaria	52	310	103	619	1909	1754
Synedra	103	52		258	52	52
Melosira	103		52	103	516	
Navicula	52	361			52	
Gyrosigma		52				
Meridion				52		
Blue-greens:						
Anacystis		52				52
Oscillatoria		205	155	155	155	52
Green:						
Pediastrum	361	206	155	206	309	412
Staurastrum	52	103	52	103		
Coelastrum				52		
Spirogyra						52
Chaetophora	103	155				
Mougeotia		155	206	206	103	258
Closteriopsis	412	361	361	103	516	52
Characiopsis		103	52	52		
Actinastrum				52		

TABLE 14

Station Sample Number	1 9477-B	3 9475-B	5 9473-B	6 9472-B	8 9467-B	11 9470-B
Organism						
Pyrrhophyta:						
Ceratium				52	258	
Other:						
Phacus	103	155	103	52		
Zooplankton						
Rotifers:						
Keratella	52				52	
Polyarthra					52	52
Protozoans:						
Difflugia					52	
Total Number/liter	1496	2271	1342	2065	4026	2943

TABLE 15
Genesee River
Plankton Abundance and Composition
October 18-19, 1973
Number of organisms/liter

Station	1	3	5	6	8	11
Sample Number	9486-S	9485-S	9484-S	9483-S	9478-S	9481-S
Organism						
Phytoplankton						
Diatoms:						
Asterionella	103		103	593	412	206
Tabellaria	52	52	52	122	52	155
Fragilaria	103	103	206	1020	464	516
Synedra	52		52		103	103
Melosira	103					
Cyclotella	52					
Navicula				40		
Stephanodiscus				40		
Blue-greens:						
Oscillatoria	103			408		155
Green:						
Pediastrum	155	206	206	857	774	464
Staurastrum	155	52		122	103	103
Scenedesmus			52			
Cosmarium	52	52				
Spirogyra			52			
Chaetophora					206	206
Schroederia				40		
Mougeotia	52	155	52			
Closteriopsis	361	52	103	244	155	206

TABLE 15

Station Sample Number	1 9486-S	3 9485-S	5 9484-S	6 9483-S	8 9478-S	11 9481-S
Organism						
Other:						
Dinobyron				40		
Zooplankton						
Rotifers:						
Keratella			52			52
Polyarthra					52	
Protozoans:						
Vorticella					103	
Total Number/liter	1343	672	930	3526	2424	2166

TABLE 16
Genesee River
Plankton Abundance and Composition
October 18-19, 1974
Number of organisms/liter

Station	1	3	5	6	8	11
Sample Number	No Sample	9485-B	9484-B	9483-B	9478-B	9481-B
Organism						
Phytoplankton						
Diatoms:						
Asterionella		448	155	734	244	619
Tabellaria		163	52	286		258
Fragilaria		734	258	2856	775	361
Synedra			103	163		103
Melosira			52			52
Navicula		81		41		52
Stephanodiscus				82		
Nitzschia		40				
Blue-greens:						
Anabaena		40		41	41	
Oscillatoria		897	155	856	244	567
Green:						
Pediastrum		448		41	612	567
Staurastrum		122		204		52
Scenedesmus				41		
Schroederia				82		
Chaetophora						310
Pandorina		40				
Mougeotia		204	155	82	122	
Closteriopsis		81	258	367	367	206
Microspora		122		82		
Closterium						52

TABLE 16

Station Sample Number	1 No Sample	3 9485-B	5 9484-B	6 9483-B	8 9478-B	11 9481-B
Organism						
Green, Con't.						
Zygnema		40				
Characiopsis			52			
Pyrrhophyta:						
Ceratium				41		
Zooplankton						
Rotifers:						
Keratella		40		163	81	52
Polyarthra				40		
Protozoans:						
Vorticella			52			
Copepods:						
Camplus				40		
Cladocerans:						
Bosmina		40			81	
Diaphanosoma				40		
Total Number/liter		3540	1292	6282	2567	3251

TABLE 17
Genesee River Data
Benthic Samples
$\bar{N}/m^2$

Station Date	1 7-18	3 7-19	5 7-19	6 7-19	8 7-18	11 7-18
ANNELIDA						
Oligochaeta						
Lumbriculidae						
cf. *Lumbriculus* *variegatus* Müller						
Naididae						
Aulophorus *pectinatus* Stephenson[1]					192.57	
Aulophoras sp.					44.44	
Dero sp. (?)						
Nais *variabilis* Piquet						
Unidentifiable Naididae						
Tubificidae						
Aulodrilus *piqueti* Kowalewski						66.66
Ilyodrilus *tempeltoni* (Southern)						
Limnodrilus *cervix* Brinkhurst[2]		44.44				266.64
Limnodrilus *claparedeianus* Ratzel[2]					103.69	
Limnodrilus *hoffmeisteri* Claparède		44.44	59.25		74.07	111.10
Limnodrilus *udekemianus* Claparède						
Unidentifiable tubificidae with caps.[3]						
Unidentifiable tubificidae without caps.						
Unidentifiable immature with caps.[4]					14.81	
Unidentifiable immature without caps.		44.44	1,585.03	133.32	88.88	488.84
ARTHROPODA						
Arachnida						
Acari (unidentifiable)						
Eucrustacea						
Malacostraca						
Isopoda						
Asellidae						
Asellus *millitaris* Hay					14.81	

TABLE 17,Continued

Station Date	1 7-18	3 7-19	5 7-19	6 7-19	8 7-18	11 7-18
Amphipoda						
Gammaridae						
Gammarus sp.					74.07	22.22
Unidentifiable Gammaridae (immature)					29.63	
Insecta						
Ephemeroptera						
Ephemeridae						
Hexagenia sp.						
Caenidae						
Caenis sp.						
Odonata (Anisoptera)						
Gomphidae						
Dromogomphus sp.						
Unidentifiable Gomphidae (poor specimen)						
Trichoptera						
Leptoceridae						
Unidentifiable immature Leptoceridae						
Coleoptera						
Elmidae (larvae)		88.88	14.81			
Diptera						
Ceratopogonidae (larvae)						
Chironomidae						
Chironominae						
Chironomus sp.		22.22				444.40
Chironomus sp. pupae						
Cladotanytarsus sp.[5]						
Cryptochironomus sp. A[6]						
Cryptochironomus sp. B		22.22				
Cryptochironomus cf. *armenicus*						
Cryptochironomus cf. *burganadzea*						
Cryptochironomus cf. *conjugens*						
Cryptochironomus cf. *defectus*						
Cryptochironomus cf. *fuscimanus*						
Cryptochironomus cf. *vulneratus*						

TABLE 17, Continued

Station Date	1 7-18	3 7-19	5 7-19	6 7-19	8 7-18	11 7-18
Unidentifiable Cryptochironomus sp.						
Cryptocladopelma sp. I						
Cryptocladopelma sp. 2						
Dicrotendipes cf. modestus						
Einfeldia sp.					162.95	22.22
Parachironomus sp.						
Polypedilum sp.		22.22				
Rheotanytarsus sp.						
Stenochironomus sp.						
Tanytarsus (Group A) sp.[5]						
Tanytarsus sp.						
Xenochironomus sp.						
Unidentifiable Chironominae specimens						
Unidentifiable Tanytarsini specimens						
Unidentifiable Chironomidae specimens						44.44
Unidentifiable Chironominae pupa[7]						[22.22]
Unidentifiable Chironomidae pupa						
Orthocladiinae						
Psectrocladius sp.					14.81	
Tanypodinae						
Larsia sp. (Pentaneurini)					14.81	
Macropelopiini (Psilotanypus + Procladius)		44.44			29.63	66.66
Macropelopiini sp. 2						
Procladius sp.						
Culicidae						
Chaoborinae						
Chaoborus sp.						
Culicidae pupae						
Culicidae larvae (unidentifiable)						

TABLE 17, Continued

Station	1	3	5	6	8	11
Date	7-18	7-19	7-19	7-19	7-18	7-18
MOLLUSCA						
Pelecypoda						
Sphaeriidae						
Sphaerium sp. (immature)						

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[1] Examined by Dr. David G. Cook, Canada Centre for Inland Waters, Burlington, Ontario, Canada. Tentative identification.

[2] These included a series of possible intermediates or hybirds.

[3] =Unidentifiable Tubificidae with/without capilliform chaetae.

[4] U.I. w. caps = Unidentifiable immatures with capilliform chaetae.
U.I. wo. caps = Unidentifiable immatures without capilliform chaetae.

[5] According to Roback, 1957.

[6] Cryptochironomus cf. digitatus. All other Cryptochironomus identified with larval key of Chernovski, 1949.

[7] Pupa not included in totals.

TABLE 18
Genesee River Data
Benthic Samples
$\bar{N}/m^2$

Station Date	1 8-15	3 8-15	5 8-15	6 8-15	8 8-15	11 8-15
ANNELIDA						
Oligochaeta						
Lumbriculidae						
cf. Lumbriculus variegatus Müller						103.69
Naididae						
Aulophorus pectinatus Stephenson[1]						
Aulophoras sp.						
Dero sp. (?)						
Nais variabilis Piquet					14.81	
Unidentifiable Naididae						
Tubificidae						
Aulodrilus piqueti Kowalewski				14.81	44.44	14.81
Ilyodrilus tempeltoni (Southern)						14.81
Limnodrilus cervix Brinkhurst[2]						
Limnodrilus claparedeianus Ratzel[2]		14.81	370.23	622.16		548.09
Limnodrilus hoffmeisteri Claparède			14.81	74.07	103.69	88.88
Limnodrilus udekemianus Claparède			29.63	59.25		14.81
Unidentifiable tubificidae with caps.[3]						
Unidentifiable tubificidae without caps.						
Unidentifiable immature with caps.[4]						
Unidentifiable immature without caps.		44.44	770.29	1,984.99	429.59	562.91
ARTHROPODA						
Arachnida						
Acari (unidentifiable)						
Eucrustacea						
Malacostraca						
Isopoda						
Asellidae						
Asellus millitaris Hay						

TABLE 18, Continued

Station Date	1 8-15	3 8-15	5 8-15	6 8-15	8 8-15	11 8-15
Amphipoda						
Gammaridae						
Gammarus sp.						
Unidentifiable Gammaridae (immature)						
Insecta						
Ephemeroptera						
Ephemeridae						
Hexagenia sp.						
Caenidae						
Caenis sp.						
Odonata (Anisoptera)						
Gomphidae						
Dromogomphus sp.				14.87		
Unidentifiable Gomphidae (poor specimen)						
Trichoptera						
Leptoceridae						
Unidentifiable immature Leptoceridae						
Coleoptera						
Elmidae (larvae)		44.44	14.81			
Diptera						
Ceratopogonidae (larvae)						
Chironomidae						
Chironominae						
Chironomus sp.		207.39	651.79	711.04		251.83
Chironomus sp. pupae			[29.63]			
Cladotanytarsus sp.[5]				14.81		
Cryptochironomus sp. A[6]		14.81	148.13	88.88		14.81
Cryptochironomus sp. B				14.81		
Cryptochironomus cf. armenicus			14.81			
Cryptochironomus cf. burganadzea		29.63				
Cryptochironomus cf. conjugens		162.95	29.63			
Cryptochironomus cf. defectus	44.44					
Cryptochironomus cf. fuscimanus		14.81				
Cryptochironomus cf. vulneratus						

TABLE 18, Continued

Station Date	1 8-15	3 8-15	5 8-15	6 8-15	8 8-15	11 8-15
Unidentifiable Cryptochironomus sp.		14.81				
Cryptocladopelma sp. I				118.51		
Cryptocladopelma sp. 2				14.81		
Dicrotendipes cf. modestus						
Einfeldia sp.			59.25			
Parachironomus sp.			14.81			
Polypedilum sp.	59.25	148.13	548.09	59.25		
Rheotanytarsus sp.						
Stenochironomus sp.			14.81			
Tanytarsus (Group A) sp.[5]				14.81		
Tanytarsus sp.		29.63				
Xenochironomus sp.	14.81					
Unidentifiable Chironominae specimens			29.63			
Unidentifiable Tanytarsini specimens			14.81			
Unidentifiable Chironomidae specimens		74.07	44.44			
Unidentifiable Chironominae pupa[7]	[29.63]			[14.81]		
Unidentifiable Chironomidae pupa		[14.81]	[14.81]			
Orthocladiinae						
Psectrocladius sp.						
Tanypodinae						
Larsia sp. (Pentaneurini)						
Macropelopiini (Psilotanypus + Procladius)					14.81	414.77
Macropelopiini sp. 2				29.63		
Procladius sp.		355.52	222.20	355.52		
Culicidae						
Chaoborinae						
Chaoborus sp.	14.81					
Culicidae pupae						
Culicidae larvae (unidentifiable)						

TABLE 18, Continued

Station Date	1 8-15	3 8-15	5 8-15	6 8-15	8 8-15	11 8-15
MOLLUSCA						
Pelecypoda						
Sphaeriidae						
Sphaerium sp. (immature)		14.81				

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[1] Examined by Dr. David G. Cook, Canada Centre for Inland Waters, Burlington, Ontario, Canada. Tentative identification.

[2] These included a series of possible intermediates or hybirds.

[3] =Unidentifiable Tubificidae with/without capilliform chaetae.

[4] U.I. w. caps = Unidentifiable immatures with capilliform chaetae.
U.I. wo. caps = Unidentifiable immatures without capilliform chaetae.

[5] According to Roback, 1957.

[6] Cryptochironomus cf. digitatus. All other Cryptochironomus identified with larval key of Chernovski, 1949.

[7] Pupa not included in totals.

TABLE 19
Genesee River Data
Benthic Samples
$\bar{N}/m^2$

Station Date	1 9-11	3 9-11	5 9-11	6 9-11	8 9-10	11 9-10
ANNELIDA						
Oligochaeta						
Lumbriculidae						
cf. Lumbriculus variegatus Müller						
Naididae						
Aulophorus pectinatus Stephenson[1]						
Aulophoras sp.						
Dero sp. (?)					14.81	
Nais variabilis Piquet			14.81	14.81		
Unidentifiable Naididae						
Tubificidae						
Aulodrilus piqueti Kowalewski			14.81			
Ilyodrilus tempeltoni (Southern)						
Limnodrilus cervix Brinkhurst[2]						
Limnodrilus claparedeianus Ratzel[2]	29.63		103.69	281.45	222.20	533.2
Limnodrilus hoffmeisteri Claparède				118.51	192.57	237.0
Limnodrilus udekemianus Claparède						
Unidentifiable tubificidae with caps.[3]						
Unidentifiable tubificidae without caps.						59.2
Unidentifiable immature with caps.[4]						
Unidentifiable immature without caps.	207.39	44.44	1,273.95	1,007.31	488.84	1,318.3
ARTHROPODA						
Arachnida						
Acari (unidentifiable)	14.81					
Eucrustacea						
Malacostraca						
Isopoda						
Asellidae						
Asellus millitaris Hay						

TABLE 19, Continued

Station Date	1 9-11	3 9-11	5 9-11	6 9-11	8 9-10	11 9-10
Amphipoda						
Gammaridae						
Gammarus sp.						
Unidentifiable Gammaridae (immature)						
Insecta						
Ephemeroptera						
Ephemeridae						
Hexagenia sp.	14.81					
Caenidae						
Caenis sp.						
Odonata (Anisoptera)						
Gomphidae						
Dromogomphus sp.						
Unidentifiable Gomphidae (poor specimen)						
Trichoptera						
Leptoceridae						
Unidentifiable immature Leptoceridae		14.81				
Coleoptera						
Elmidae (larvae)						
Diptera						
Ceratopogonidae (larvae)	14.81					
Chironomidae						
Chironominae						
Chironomus sp.		59.25		207.33	14.81	29.63
Chironomus sp. pupae						
Cladotanytarsus sp.[5]						
Cryptochironomus sp. A[6]	14.81	14.81				
Cryptochironomus sp. B						
Cryptochironomus cf. *armenicus*						
Cryptochironomus cf. *burganadzea*						
Cryptochironomus cf. *conjugens*		29.63	14.81			
Cryptochironomus cf. *defectus*						
Cryptochironomus cf. *fuscimanus*	29.63					
Cryptochironomus cf. *vulneratus*		14.81				

TABLE19, Continued

Station Date	1 9-11	3 9-11	5 9-11	6 9-11	8 9-10	11 9-10
Unidentifiable Cryptochironomus sp.						
Cryptocladopelma sp. I						
Cryptocladopelma sp. 2						
Dicrotendipes cf. modestus						
Einfeldia sp.						
Parachironomus sp.				14.81		
Polypedilum sp.		14.81				
Rheotanytarsus sp.						
Stenochironomus sp.						
Tanytarsus (Group A) sp.[5]	14.81					
Tanytarsus sp.						
Xenochironomus sp.						
Unidentifiable Chironominae specimens		44.44	14.81			
Unidentifiable Tanytarsini specimens						
Unidentifiable Chironomidae specimens						
Unidentifiable Chironominae pupa[7]						
Unidentifiable Chironomidae pupa		[14.81]				[29.63]
Orthocladiinae						
Psectrocladius sp.						
Tanypodinae						
Larsia sp. (Pentaneurini)						
Macropelopiini (Psilotanypus + Procladius)						59.25
Macropelopiini sp. 2						
Procladius sp.			14.81	59.25		44.44
Culicidae						
Chaoborinae						
Chaoborus sp.				14.81		14.81
Culicidae pupae			[14.81]			
Culicidae larvae (unidentifiable)						

TABLE 19, Continued

	1	3	5	6	8	11
Station Date	9-11	9-11	9-11	9-11	9-10	9-10
MOLLUSCA						
Pelecypoda						
Sphaeriidae						
Sphaerium sp. (immature)						

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[1] Examined by Dr. David G. Cook, Canada Centre for Inland Waters, Burlington, Ontario, Canada. Tentative identification.

[2] These included a series of possible intermediates or hybirds.

[3] =Unidentifiable Tubificidae with/without capilliform chaetae.

[4] U.I. w. caps = Unidentifiable immatures with capilliform chaetae.
U.I. wo. caps = Unidentifiable immatures without capilliform chaetae.

[5] According to Roback, 1957.

[6] *Cryptochironomus* cf. *digitatus*. All other *Cryptochironomus* identified with larval key of Chernovski, 1949.

[7] Pupa not included in totals.

TABLE 20
Genesee River Data
Benthic Samples
$\overline{N}/m^2$

Station Date	1 9-27	3 9-27	5 9-27	6 9-26	8 9-26	11 9-26
ANNELIDA						
Oligochaeta						
Lumbriculidae						
cf. Lumbriculus variegatus Müller						
Naididae						
Aulophorus pectinatus Stephenson[1]						
Aulophoras sp.						
Dero sp. (?)			74.07			
Nais variabilis Piquet						
Unidentifiable Naididae				14.81	14.81	
Tubificidae						
Aulodrilus piqueti Kowalewski					14.81	
Ilyodrilus tempeltoni (Southern)						
Limnodrilus cervix Brinkhurst[2]						
Limnodrilus claparedeianus Ratzel[2]	74.07		162.95	133.32	370.33	814.73
Limnodrilus hoffmeisteri Claparède			14.81	29.63	118.51	488.84
Limnodrilus udekemianus Claparède						
Unidentifiable tubificidae with caps.[3]				29.63		
Unidentifiable tubificidae without caps.	14.81		29.63	148.13		59.25
Unidentifiable immature with caps.[4]					59.25	14.81
Unidentifiable immature without caps.	459.21	14.81	636.97	1,496.15	1,007.31	1,733.16
ARTHROPODA						
Arachnida						
Acari (unidentifiable)						
Eucrustacea						
Malacostraca						
Isopoda						
Asellidae						
Asellus millitaris Hay						

TABLE 20, Continued

Station Date	1 9-27	3 9-27	5 9-27	6 9-26	8 9-26	11 9-26
Amphipoda						
Gammaridae						
Gammarus sp.						
Unidentifiable Gammaridae (immature)				14.81		
Insecta						
Ephemeroptera						
Ephemeridae						
Hexagenia sp.	29.63					
Caenidae						
Caenis sp.		14.81				
Odonata (Anisoptera)						
Gomphidae						
Dromogomphus sp.						
Unidentifiable Gomphidae (poor specimen)		14.81				
Trichoptera						
Leptoceridae						
Unidentifiable immature Leptoceridae		14.81				
Coleoptera						
Elmidae (larvae)						
Diptera						
Ceratopogonidae (larvae)						
Chironomidae						
Chironominae						
Chironomus sp.		29.63	44.44	177.76		
Chironomus sp. pupae						
Cladotanytarsus sp.[5]						
Cryptochironomus sp. A[6]	29.63					
Cryptochironomus sp. B						
Cryptochironomus cf. *armenicus*						
Cryptochironomus cf. *burganadzea*	29.63					
Cryptochironomus cf. *conjugens*						
Cryptochironomus cf. *defectus*						
Cryptochironomus cf. *fuscimanus*						
Cryptochironomus cf. *vulneratus*						

TABLE 20, Continued

Station	1	3	5	6	8	11
Date	9-27	9-27	9-27	9-26	9-26	9-26
Unidentifiable Cryptochironomus sp.						
Cryptocladopelma sp. I						
Cryptocladopelma sp. 2						
Dicrotendipes cf. modestus		88.88				
Einfeldia sp.						
Parachironomus sp.						
Polypedilum sp.		14.81				
Rheotanytarsus sp.		14.81				
Stenochironomus sp.						
Tanytarsus (Group A) sp.[5]						
Tanytarsus sp.						
Xenochironomus sp.						
Unidentifiable Chironominae specimens	14.81	14.81		29.63		
Unidentifiable Tanytarsini specimens						
Unidentifiable Chironomidae specimens	14.81	14.81	14.81	14.81		
Unidentifiable Chironominae pupa[7]	[14.81]	[14.81]		[14.81]		
Unidentifiable Chironomidae pupa					[14.81]	
Orthocladiinae						
Psectrocladius sp.						
Tanypodinae						
Larsia sp. (Pentaneurini)						
Macropelopiini (Psilotanypus + Procladius)						
Macropelopiini sp. 2						
Procladius sp.						
Culicidae						
Chaoborinae						
Chaoborus sp.						
Culicidae pupae						
Culicidae larvae (unidentifiable)			14.81			74.07

TABLE 20, Continued

Station Date	1 9-27	3 9-27	5 9-27	6 9-26	8 9-26	11 9-26
MOLLUSCA						
Pelecypoda						
Sphaeriidae						
Sphaerium sp. (immature)						

[1] Examined by Dr. David G. Cook, Canada Centre for Inland Waters, Burlington, Ontario, Canada. Tentative identification.

[2] These included a series of possible intermediates or hybirds.

[3] =Unidentifiable Tubificidae with/without capilliform chaetae.

[4] U.I. w. caps = Unidentifiable immatures with capilliform chaetae.
U.I. wo. caps = Unidentifiable immatures wihtout capilliform chaetae.

[5] According to Roback, 1957.

[6] Cryptochironomus cf. digitatus. All other Cryptochironomus identified with larval key of Chernovski, 1949.

[7] Pupa not included in totals.

TABLE 21

Distribution of Fish in the Genesee River
October 18-19, 1973

	STATION					
	1	3	5	6	8	11
Smallmouth Bass	3	1				
Walleye			2	1		
Golden Shiner			8	12	32	
Rock Bass	5	12			1	3
Bullheads	2	4				
White Perch						2
Alewifes					6	13
Suckers		2	10	6	8	4
Carp	—	—	4	3	2	2
TOTAL NUMBER	10	19	24	22	49	24